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CENTRAL COAST WATER QUALITY PRESERVATION, INC

Central Coast Cooperative Monitoring Program

2014 Annual Water Quality Report

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EXECUTIVE SUMMARY

This report describes the results of monitoring conducted by Central Coast Water Quality Preservation, Inc. (CCWQP) in 2014 for the Central Coast Regional Water Quality Control Board's (CCRWQCB) Agricultural Order (*Order No. R3-2012-0011)*. CCWQP implements the Central Coast Cooperative Monitoring Program (CMP) under the cooperative monitoring option provided in the Agricultural Order, and initiated monitoring in January 2005.

The objectives of the CMP, described in the Monitoring and Reporting Program No. RB3-2012-0011 (CCWRQCB 2012a-c), are to:

a) assess the impacts of waste discharges from irrigated lands to receiving water;
b) assess the status of receiving water quality and beneficial use protection in impaired waterbodies dominated by agricultural activity;
c) evaluate status, short term patterns and long term trends (five to ten years or more) in receiving water quality;
d) evaluate water quality impacts resulting from agricultural discharges (including but not limited to tile drain discharges);
e) evaluate stormwater quality;
f) evaluate condition of existing perennial, intermittent, or ephemeral streams or riparian or wetland area habitat, including degradation resulting from erosion or agricultural discharges of waste; and
g) assist in the identification of specific sources of water quality problems.

An additional objective of the original program is to provide feedback to growers in areas of concern in order to facilitate water quality improvements.

The CMP has traditionally included 50 regularly monitored sites located in six hydrologic units in the Central Coast region. The CMP initially included 25 sites in the Santa Maria region in Santa Barbara County (and including a small area of southern San Luis Obispo County) and the lower Salinas River region in Monterey County. In 2006, the CMP was expanded to include an additional 25 sites. In 2012 the CMP was modified to include a total of 7 additional sites (5 in the northern monitoring area and 2 in the southern region), with 2 sites removed (1 in the north and 1 in the south). The additional sites are addressed via a combination of direct monitoring by the CMP and data from other programs already monitoring them. These were added to the CMP to provide information about additional impaired water bodies in watersheds with agricultural land use. The removed sites either did not convey sufficient amounts of water and/or did not reflect sufficient agricultural land use to merit continued monitoring efforts by the program.

The CMP includes chemical, physical, toxicological, and biological monitoring elements. Samples are collected in a manner appropriate for the specific analytical methods used. Water samples are typically collected as mid-depth mid-channel grab samples. Standard operating procedures for collection and analysis of surface water, sediment, and bioassessment samples are provided in the CMP's Quality Assurance Project Plan, or QAPP (CCWQP 2013). The QAPP documents the sampling and analytical methods, procedures, and requirements, data management procedures, Quality Assurance sample requirements and frequency, the data quality objectives for the CMP, and corrective actions for quality assurance problems.

All 12 CMP water column and sediment monitoring events planned for 2014 were successfully conducted, with a total of 430 of 607 planned site visits resulting in samples being collected. Of the site visits not resulting in samples being collected, 61 were because the sites were dry and 112 were because there was no connectivity between the sampling site and downstream water bodies. All of the collected samples were analyzed. The monitoring results were evaluated in accordance with the CMP QAPP (CCWQP 2013) and determined overall to be of high quality with few qualifications on their use.

Several broad regional patterns were observed in the CMP monitoring results:

- The two regions with sites located in the most intensively cropped drainages (Santa Maria region and the Salinas region) had the highest average turbidity, unionized ammonia, and nitrate results. Dissolved oxygen, pH and conductivity exceedances were more frequent in other hydrologic units (Estero Bay, Pajaro, and South Coast) but still occurring in Salinas and Santa Maria as well.
- Toxicity to fish and algae were relatively infrequent in all regions compared to invertebrate toxicity in water and sediment, however a few sites may have shifted from declining levels or no toxicity to fish/algae in 2012 to minor but increasing levels beginning in 2013 or 2014.
- The highest frequency of toxicity to invertebrate test species was observed in the Salinas and Santa Maria hydrologic units (HUs 309 and 312) in sediment and water column toxicity tests. The South Coast and Pajaro regions also exhibited sediment toxicity in a substantial number of samples.
- About 31% of possible site/parameter combinations for conventional parameters (i.e. not toxicity-related) showed trends, or changes in water quality in 2013, most of which continued in 2014.
- There were few trends in Turbidity, and these were generally decreasing , occurring in both north and south, and in summer and winter seasons.
- There were many trends in Flow, and these were almost entirely (with one exception) decreasing
  trends and occurred especially in the summer months (dry season).
- Trends in Dissolved Oxygen were mostly increasing, occurring more in the north than in the south. This could indicate improvements, or could conversely be part of a worsening trend involving reduced oxygen levels at night, caused by the same algal populations responsible for the daytime highs. The CMP does not monitor dissolved oxygen at night.
- Both Ammonia-related parameters and Orthophosphate displayed trends, however directionality, geography, and seasonality of these were somewhat scattered and difficult to interpret on a regional basis. Generally speaking, orthophosphate exhibited more increasing trends and ammonia-related parameters exhibited more decreasing trends.
- Trends in pH were observed throughout the region but most commonly in the north, with more decreasing than increasing. Trends in Salinity-related parameters were predominantly increasing in the north and decreasing in the south, especially in the summer season.

- Overall, more decreasing trends were observed for Nitrate than increasing. However, the northern sites as a distinct group exhibited more increasing trends than decreasing. It was the southern sites which showed a stronger pattern of predominantly decreasing trends. There were more trends observed in summer months than in winter months, but increasing versus decreasing trends were relatively well distributed between seasons.

The CMP results from 2014 continue to support the conclusion that low dissolved oxygen, elevated pH, elevated nitrate and ammonia, and water and sediment toxicity are parameters of concern in many water bodies in the Central Coast region. However, the presence of statistically significant trends indicates that some conditions may be changing. In many cases a sharp contrast between 2012/2013 results and those from early years of the program was apparent. Those changes, many for the better, were largely sustained in 2014. However some of the improving trends in toxicity parameters lapsed in 2014, particularly for toxicity to invertebrates in water. This bears a close watch in future years, especially as precipitation returns to more normal levels and water flows increase.

1 INTRODUCTION

1.1 BACKGROUND

In 1999, Senate Bill 923 amended California Water Code §13269 to require all waivers of waste discharge requirements existing on January 1, 2000, to expire on January 1, 2003. Irrigated agriculture was covered by a broad waiver that expired in 2003. As amended, California WC §13269 allowed waivers for specific types of discharges if the waiver met five conditions and did not exceed five years in length.

In July, 2004, the Central Coast Regional Water Quality Control Board (CCRWQCB) adopted a waiver for irrigated agriculture requiring irrigated agricultural operations to enroll under the *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Order No. R3-2004-0117)* (hereafter referred to as the *2004 Ag Waiver*) or be excluded from the conditional waiver and regulated under other CCRWQCB discharge requirements. In March of 2012, the CCRWQCB adopted a new waiver (hereafter referred to as the *2012 Ag Order*).

The 2004 Ag Waiver required farm operators with irrigated agricultural operations to meet the following requirements to participate: 1) enroll with the CCRWQCB, 2) attend a minimum of 15 hours of approved irrigation related education, 3) complete a farm water quality management plan, 4) implement management practices to improve water quality in tailwater, storm water runoff, and discharges to groundwater, and 5) perform individual water quality monitoring or participate in cooperative water quality monitoring. In order to provide guidance to facilitate meeting these requirements, the CCRWQCB developed a Monitoring and Reporting Program (MRP) that described the monitoring and reporting requirements for all farm operators. In response to the requirements, Central Coast Water Quality Preservation, Inc. (CCWQP), a non-profit corporation, was formed by the industry to implement and manage the Cooperative Monitoring Program (CMP). The CMP operated by CCWQP from 2005 through 2011 fulfilled the cooperative monitoring option provided in the 2004 Ag Waiver, and initiated monitoring in January 2005.

For the purposes of the 2004 Ag Waiver, the CMP initially conducted water quality monitoring at 25 sites within two hydrologic units: the Santa Maria River (including Oso Flaco Creek) in Santa Barbara and San Luis Obispo Counties and the Salinas River in Monterey County. This was expanded with an additional 25 sites in a second phase (beginning in 2006) to include four additional Central Coast hydrologic units. In 2012 the CMP was updated to include reporting on several additional monitoring sites via collaboration with other programs, as well as several additional water quality parameters related to nutrients and toxicity to aquatic organisms.

The overall goals of monitoring are to characterize the water quality conditions in the watersheds, to understand long-term water quality trends in agricultural areas, and to meet the requirements specified in the MRP for the Conditional Waiver (MRP No. RB3-2012-011-01, -02, and -03). Also of note is that in 2012 the MRP was updated to include additional requirements for enrolled growers, as well as a tiering system whereby enrolled farms are assigned to one of three tiers based on size, proximity to impaired waters, and use of the pest control products Chlorpyrifos or Diazon. Though the MRP requirements for the CMP are identical across tiers, each tier has its own MRP with varying additional requirements for growers. Copies of the MRP for each tier may be obtained from the CCRWQCB, or online at: http://www.swrcb.ca.gov/rwqcb3/water_issues/programs/ag_waivers/index.shtml.

Funding for CMP water quality and bioassessment monitoring during 2006-2008 was initially provided in part by two Proposition 50 Agriculture Water Quality Grant Program Grants, administered by the Central Coast Regional Water Quality Control Board. Prior to 2006, funding for CMP was provided in part by a combination of the Non-point Source Pollution Monitoring Fund for North Monterey County (PGE-SEP) and Guadalupe Oil Field Settlement funds. Since its inception, the CMP has also been supported by participation fees from Central Coast irrigated growers and land owners enrolled in the Ag Waiver. Since 2010, grower participation fees have been the sole source of income to the program. In-kind services have also been provided by many partner organizations, and through the active and generous participation of numerous industry representatives on the CCWQP board of directors and CMP committees.

1.1.1 Project Objectives and Approach

The objectives of the CMP, described in the Monitoring and Reporting Program No. RB3-2012-0011 (CCWRQCB 2012a-c), are to:

a) assess the impacts of waste discharges from irrigated lands to receiving water;

b) assess the status of receiving water quality and beneficial use protection in impaired waterbodies dominated by agricultural activity;

c) evaluate status, short term patterns and long term trends (five to ten years or more) in receiving water quality;

d) evaluate water quality impacts resulting from agricultural discharges (including but not limited to tile drain discharges);

e) evaluate stormwater quality;

f) evaluate condition of existing perennial, intermittent, or ephemeral streams or riparian or wetland area habitat, including degradation resulting from erosion or agricultural discharges of waste; and

g) assist in the identification of specific sources of water quality problems.

An additional objective of the original program was, and still is, to provide feedback to growers in areas of concern in order to facilitate water quality improvements.

1.2 PROJECT AREA

The Central Coast hydrologic region extends from southern San Mateo County in the north to Santa Barbara County in the south (Figure 1-1). The region includes all of Santa Cruz, Monterey, San Benito, San Luis Obispo and Santa Barbara counties and parts of San Mateo, Santa Clara, and Ventura counties. Most of the Central Coast region is within the Coast Range. The region’s interior boundary runs northeast to southwest along the hills bordering the San Andreas Fault Zone to the Kern County border. A few square miles of Kern County are included in the region and a few square miles of San Luis Obispo and Santa Barbara counties are excluded. To the south, a small portion of Ventura County is also included in the region.

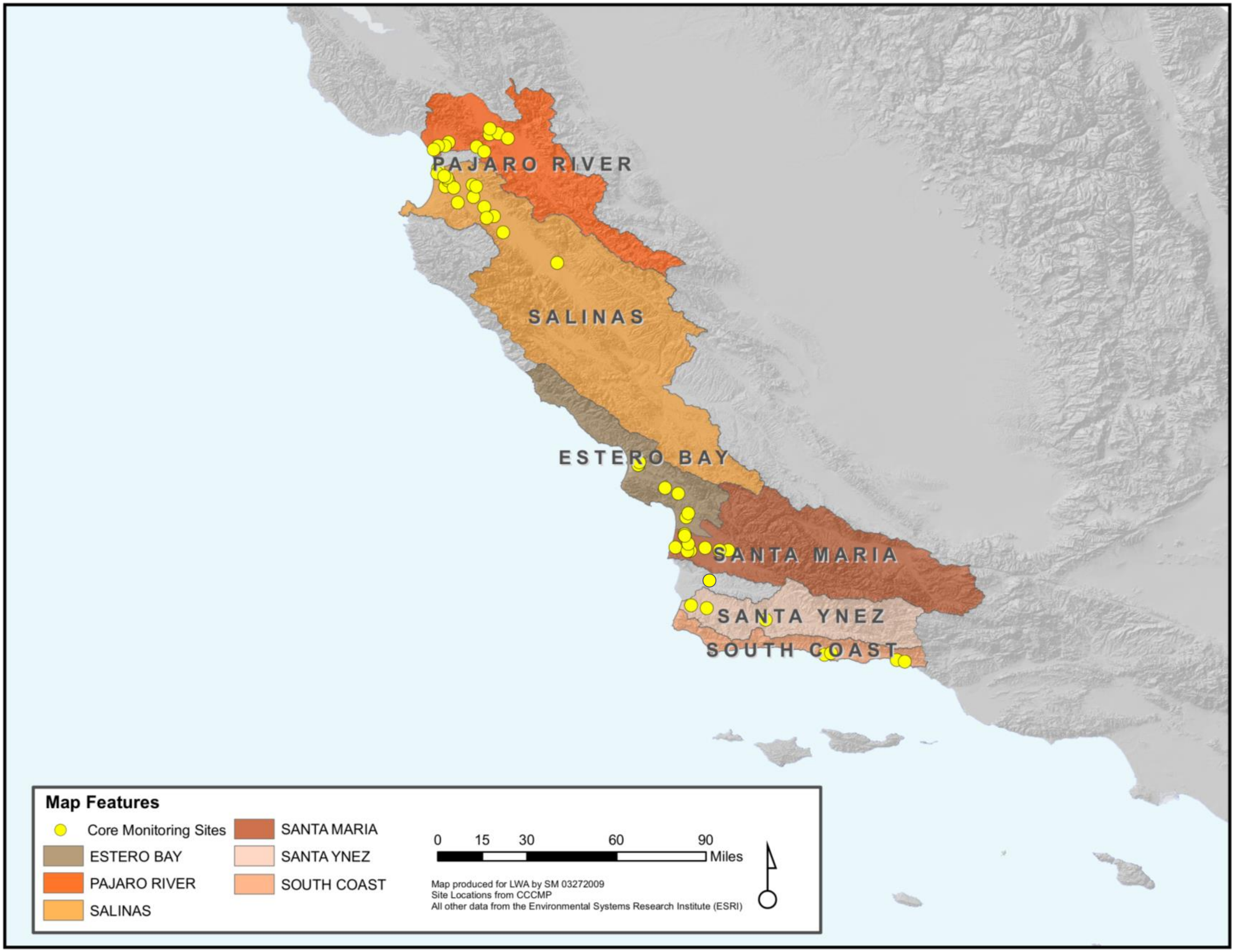
The majority of the Central Coast region is drained by four large watersheds: the Pajaro River, the Salinas River and its tributaries, the Santa Maria River, and the Santa Ynez River. The mid-coastal portion (the Estero Bay region) and extreme southern coastal portion of the region are characterized by many short, steep, and relatively small watersheds.

The climate of the Central Coast region is relatively temperate all year due to its location adjacent to the Pacific Ocean. The Central Coast has a Mediterranean climate characterized by mild, wet winters, and warm, dry summers. Annual average precipitation in the region ranges from 14 to 45 inches throughout most of the region, but southern interior basins typically receive 5 to 10 inches per year, with the mountain areas receiving more rainfall than the valley floors. Most precipitation occurs between late November and mid-April. The average annual precipitation near Salinas is about 14 inches.

Population of the Central Coast hydrologic region was approximately 1.5 million in 2005. About 65 percent of the Central Coast population lives in incorporated cities with populations greater than 20,000, including Salinas, Santa Barbara, Santa Maria, Santa Cruz, San Luis Obispo, Lompoc, Watsonville, Hollister, Seaside, Monterey, Atascadero, and Paso Robles. There are many additional small communities in the region with populations fewer than 20,000. The topography of the Central Coast region and its distance from California's major population centers results in a landscape that is largely pastoral and agricultural. Major economic activities include tourism, agriculture-related processing, and government and service-sector employment. Agriculture is the predominant land use in the Salinas Valley, Pajaro watershed, and San Luis Obispo County. Major developed land uses within the region are shown in Figure 1-1.

Additional details are provided in Section 3 for the individual hydrologic units within the Central Coast region.

Figure 1-1. Cooperative Monitoring Program project area and core monitoring sites



2 METHODS

2.1 MONITORING SITES

The CMP has traditionally included 50 regularly monitored sites located in six hydrologic units in the Central Coast region (with one site from a separate, seventh unit). The CMP initially included 25 sites in the Santa Maria region in Santa Barbara County (and including a small area of southern San Luis Obispo County) and the lower Salinas River region in Monterey County. In 2006, the CMP was expanded to include an additional 25 sites, including 10 sites in the Pajaro River watershed monitored by University of California Santa Cruz (UCSC). Monitoring by UCSC was part of the Pajaro River Monitoring Project, which ran from 2005 through 2008 with funding from the Regional Board (Grant ID #05-102-553-0: *Long-Term High Resolution Nutrient & Sediment Monitoring*).

In 2012 the CMP was modified to include a total of 7 additional sites (5 in the northern monitoring area and 2 in the southern region), with 2 sites removed (1 in the north and 1 in the south). The additional sites are addressed via a combination of direct monitoring by the CMP and data from other programs already monitoring them. These were added to the CMP to provide information about additional impaired water bodies in watersheds with agricultural land use. The removed sites either did not convey sufficient amounts of water and/or did not reflect sufficient agricultural land use to merit continued monitoring efforts by the program.

Cooperative monitoring sites are listed with brief descriptions in Table 2-1. Additional details for each hydrologic unit and region are provided in Section 3 (Water Quality Monitoring Results).

2.2 MONITORING PARAMETERS AND SCHEDULE

The CMP includes chemical, physical, toxicological, and biological monitoring elements. Samples are collected in a manner appropriate for the specific analytical methods used. Water samples were typically collected as mid-depth mid-channel grab samples. Standard operating procedures for collection and analysis of surface water, sediment, and bioassessment samples are provided in the CMP Quality Assurance Project Plan, or QAPP (CCWQP 2013).

The core CMP monitoring components and schedule consist of the following:

- Chemical and physical constituents (nitrate, total ammonia, dissolved orthophosphate, chlorophyll-*a*, dissolved oxygen, temperature, total dissolved solids, specific conductance, salinity, pH, turbidity, and flow) are measured monthly; additional chemical parameters added in 2012 are total nitrogen and total phosphorus; an additional physical parameter added in 2012 is total suspended solids;
- Chronic toxicity of ambient waters is assessed with three species (invertebrates, fish, and algae), 4 times a year (twice during the dry season and twice during the wet season);
- Sediment toxicity testing is conducted once each year in spring;
- Benthic macroinvertebrate assessments are conducted once per 5 year Order period in spring. Results discussed in a separate report (CCWQP 2015);

- Assessments of aquatic habitat and water body condition (filamentous algae and periphyton coverage, dominant substrate, bank vegetation and shading) are conducted monthly as part of the regularly scheduled monitoring, and in more detail for macroinvertebrate bioassessment monitoring once per 5 year Order cycle;
- Supplemental analyses of potential toxicants (i.e. pesticides, herbicides, metals) were conducted initially (2006-2011) as focused "follow-up" projects to address exceedances of Basin Plan narrative objectives related to aquatic toxicity, observed during core CMP monitoring. In the 2012-2017 Waiver period, supplemental analyses were conducted on a more comprehensive basis, at all sites during either the 2013 or 2014 monitoring year. Results for supplemental monitoring parameters are discussed in a separate report, in the context of concurrent toxicity testing results (CCWQP 2016).

These parameters were selected to evaluate whether water and habitat quality in agricultural regions support the beneficial uses designated for Central Coast water bodies in the Basin Plan (Table 2-2). Water quality objectives for specific monitoring parameters and their related beneficial uses are summarized in Table 2-3. These indicators of water quality and their relationship to beneficial uses defined in the Central Coast Basin Plan have also been used previously by the CCRWQCB to assess Central Coast water bodies.

For sites without beneficial uses designated in the Basin Plan (Basin Plan table 2-1), the Basin Plan specifies that they are assigned the following designations: Municipal and Domestic Water Supply, and protection of both recreation and aquatic life uses. The water quality objectives associated with these uses are therefore applicable in these water bodies. The Basin Plan also assigns specific numeric water quality objectives for dissolved oxygen, oxygen saturation, pH, and unionized ammonia to all water bodies.

The Basin Plan also includes ranges of numeric objectives for ammonia, nitrate, and conductivity to protect agricultural beneficial uses (AGR). However, the method to implement and interpret the different ranges is not specified in Basin Plan. For the purpose of this report, concentrations are compared to the low range of these objectives but should not be interpreted as exceedances.

2.3 WATER COLUMN AND SEDIMENT SAMPLES

Water quality samples were collected using clean techniques that minimize sample contamination. Grab samples were generally collected by wading to mid-stream and filling bottles by direct submersion of the sample bottle or from a secondary clean container. Sediment samples consisted of composite samples of the top 2 cm of fine-grained sediments, which is intended to ensure collection of relatively recent deposition (though not necessarily recent erosion from the surrounding watershed).

Analyses of water column samples included conventional and physical measures of water quality, nitrogen and phosphorus compounds, toxicity, and pesticides. These analyses were performed in filtered (dissolved) or unfiltered (total) samples, as appropriate for the analyte of concern. All pesticide analyses were conducted on unfiltered samples. Analysis of sediment samples was limited to toxicity testing with a single invertebrate species.

Chemical analyses were performed by Fruit Growers Laboratory, Inc. (San Luis Obispo, California) and Physis Environmental Laboratory (Anaheim, California).

Additional details of procedures for collecting water and sediment samples for chemical analyses and toxicity testing are provided in Section B.3 and Appendix A of the QAPP (CCWQP 2013).

2.4 TOXICITY TESTING

Water quality samples were analyzed for chronic toxicity to a sensitive invertebrate species (*Ceriodaphnia dubia* or water flea), fish species (*Pimephales promelas* or fathead minnow), and algae species (*Selenastrum capricornutum*). Determination of chronic toxicity was performed using *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, 4th Edition* (USEPA 2002). Toxicity tests with *Ceriodaphnia* and *Pimephales* were conducted as 7-day static renewal tests with sample renewals every 48 hours after test initiation. Toxicity tests with *Selenastrum* were conducted as a 96-hour static non-renewal test. Sediment samples were analyzed for toxicity to the amphipod *Hyalella azteca*. Determination of toxicity was performed as described in *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Organisms* (USEPA 2000). Chronic toxicity tests on invertebrate and fish species included lethal (mortality) and sublethal endpoints (reproduction or growth).

All toxicity testing was performed by Pacific EcoRisk Laboratory (Fairfield, California). All statistical analyses were performed using the CETIS® statistical package (Version 1.1.2revL, TidePool Scientific, McKinleyville, CA).

The salinity of the ambient waters sometimes exceeded the tolerance of the standard freshwater test species. In these cases alternate salinity-tolerant test species were used for toxicity tests with invertebrate species (*Hyalella azteca*, *Eohaustorius estuarius*, or *Americamysis bahia*), fish species (*Cyprinodon variegatus*), and algae species (*Thalassiosira pseudonana*):

- The *Thalassiosira* algal growth test was performed in place of the *Selenastrum* for water samples with conductivity greater than 3000 µS/cm.
- The 10-day *Hyalella* test was performed in place of the *Ceriodaphnia* test for water samples with a conductivity greater than 3000 µS/cm but less than 10,000 µS/cm. The chronic *Americamysis* test was performed in place of the *Ceriodaphnia* test for water samples with conductivity less than10,000 µS/cm.
- The chronic sheepshead minnow test was performed in place of the fathead minnow test for water samples with conductivity greater than 3000 µS/cm.
- The *Eohaustorius* sediment test was performed in place of the *Hyalella* test for sediment samples with interstitial water salinity greater than 15 PPT.

Details of toxicity testing methods and procedures for are provided in Appendix B of the QAPP (CCWQP 2013).

2.5 QUALITY ASSURANCE

Implementation of the CMP is conducted according to the approved Quality Assurance Project Plan (QAPP). The QAPP was initially approved in 2005 and was revised and subsequently amended in 2006 for the expansion of the CMP. The QAPP documents the sampling and analytical methods, procedures, and requirements, data management procedures, Quality

Assurance sample requirements and frequency, the data quality objectives for the CMP, and corrective actions for quality assurance problems.

Table 2-1. Core Monitoring Locations, 2012

Region	Site ID[1]	Site Description
Lower Pajaro	305COR	Salsipuedes Creek downstream of Corralitos Creek upstream from Hwy 129
Lower Pajaro	305PJP	Pajaro River at Main Street
Lower Pajaro	305WSA	Watsonville Slough at San Andreas Rd
Lower Pajaro	305BRS	Beach Road Ditch at Shell Rd
Lower Pajaro	305WCS	Watsonville Creek at Salinas Road/Hudson Landing
Upper Pajaro	305CAN	Carnadero Creek upstream of Pajaro River
Upper Pajaro	305CHI	Pajaro River at Chittenden
Upper Pajaro	305FRA	Millers Canal at Frazier Lake Rd
Upper Pajaro	305LCS	Llagas Creek at Southside
Upper Pajaro	305SJA	San Juan Creek at Anzar Rd
Upper Pajaro	305TSR	Tequisquita Slough upstream Pajaro River @ Shore Rd
Upper Pajaro	305FUF	Furlong Creek at Frazier Lake Rd.
Castroville & Blanco	306MOR	Moro Cojo Slough at Highway 1
Castroville & Blanco	309ASB	Alisal Slough at White Barn
Castroville & Blanco	309BLA	Blanco Drain below Pump
Castroville & Blanco	309ESP	Espinosa Slough upstream from Alisal Slough
Castroville & Blanco	309GAB	Gabilan Creek at Boronda Road
Castroville & Blanco	309JON	Salinas Reclamation Canal at San Jon Road
Castroville & Blanco	309MER	Merrit Ditch upstream from Highway 183
Castroville & Blanco	309NAD	Natividad Creek upstream from Salinas Reclamation Canal
Castroville & Blanco	309OLD	Old Salinas River at Monterey Dunes Way
Castroville & Blanco	309TEH	Tembladero Slough at Haro
Lower Salinas	309ALG	Salinas Reclamation Canal at La Guardia
Lower Salinas	309CRR	Chualar Creek at Chualar River Road
Lower Salinas	309GRN	Salinas River at Elm Rd in Greenfield
Lower Salinas	309QUI	Quail Creek at Highway 101
Lower Salinas	309RTA	Santa Rita Creek at Santa Rita Creek Park
Lower Salinas	309SAC	Salinas River at Chualar bridge on River Road
Lower Salinas	309SAG	Salinas River at Gonzales River Rd Bridge
Lower Salinas	309SSP	Salinas River at Spreckels Gage
Arroyo Grande	310LBC	Los Berros Creek at Century
Arroyo Grande	310USG	Arroyo Grande Creek at old USGS gage
San Luis Obispo	310CCC	Chorro Creek upstream from Chorro Flats
San Luis Obispo	310PRE	Prefumo Creek at Calle Joaquin
San Luis Obispo	310SLD	Davenport Creek at Broad Street
San Luis Obispo	310WRP	Warden Creek at Wetlands Restoration Preserve
Santa Maria	312BCC	Bradley Canyon Creek
Santa Maria	312BCJ	Bradley Channel at Jones Street
Santa Maria	312GVS	Green Valley at Simas
Santa Maria	312MSD	Main Street Canal upstream from Ray Road at Highway 166

Region	Site ID[1]	Site Description
Santa Maria	312OFC	Oso Flaco Creek at Oso Flaco Lake Road
Santa Maria	312OFN	Little Oso Flaco Creek
Santa Maria	312ORC	Orcutt Solomon Creek upstream from Santa Maria River
Santa Maria	312ORI	Orcutt Solomon Creek at Highway 1
Santa Maria	312SMI	Santa Maria River at Highway 1
Santa Maria	312SMA	Santa Maria River at Estuary
Santa Maria	312SMI	Santa Maria River at Highway 1
San Antonio	313SAE	San Antonio Creek at San Antonio Road East
Lompoc	314SYF	Santa Ynez River at Floradale
Lompoc	314SYL	Santa Ynez River at River Park
Lompoc	314SYN	Santa Ynez River at 13th
Santa Barbara	315APF	Arroyo Paredon at Foothill Road
Santa Barbara	315BEF	Bell Creek at Winchester Canyon Park
Santa Barbara	315FMV	Franklin Creek at Mountain View Ln
Santa Barbara	315GAN	Glenn Annie
Santa Barbara	315LCS	Los Carneros Creek at Calle Real

1 The first three digits of the Site ID correspond to the Hydrologic Unit Code (HUC) for each region. In this report, site 306MOR is included in the adjacent Salinas Hydrologic Unit (HU 309) for discussion purposes.
HUC Key: 305=Pajaro; 309=Salinas; 310=Estero Bay; 312=Santa Maria; 314=Santa Ynez; 315=South Coast

Table 2-2. Designated Beneficial Uses for Core CMP Monitoring Locations

CMP Site ID	Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	COMM	SHELL
		Beneficial Use Codes[1]																	
	PAJARO RIVER HYDROLOGIC UNIT																		
305PJP	Pajaro River	X	X		X	X	X	X	X	X	X	X	X				X	X	
305CHI	Pajaro River	X	X		X	X	X	X	X	X	X	X	X				X	X	
305FRA	Millers Canal at Frazier Lake Rd	(2)					(2)			(2)									
NA	San Benito River	X	X		X	X	X	X	X		X		X				X	X	
305SJA	San Juan Creek at Anzar Rd	(2)					(2)			(2)									
305TSR	Tequisquita Slough					X	X	X	X		X		X					X	
305LCS	Llagas Creek (below Chesbro Res.)	X	X		X	X	X	X	X	X	X	X	X		X			X	
305CAN	Carnadero Creek	X				X	X	X	X	X	X	X			X			X	
305COR	Salsipuedes Creek	X	X			X	X	X	X	X		X	X					X	
305WSA	Watsonville Slough						X	X	X		X		X	X	X	X		X	
305STL	Struve Slough						X	X	X		X		X	X	X	X		X	
	SALINAS HYDROLOGIC UNIT																		
306MOR	Moro Cojo Slough					X	X	X	X	X	X		X	X	X	X		X	X
309OLD	Old Salinas River Estuary						X	X	X	X	X	X	X	X	X	X		X	X
309TEH	Tembladero Slough						X	X	X		X		X		X	X		X	X
309MER	Merrit Ditch upstream from Highway 183	(2)					(2)			(2)									
309ESP	Espinosa Slough						X	X	X		X							X	
309JON	Salinas Reclamation Canal						X	X	X		X							X	
309ALG	Salinas Reclamation Canal						X	X	X		X							X	
309NAD	Natividad Creek upstream from Salinas Reclamation Canal	(2)					(2)			(2)									
309GAB	Gabilan Creek	X	X			X	X	X	X		X		X					X	
309ASB	Alisal Creek	X	X			X	X	X	X	X	X		X					X	
309BLA	Blanco Drain						X	X	X		X							X	
309SSP	Salinas River, dnstr of Spreckels Gage	X	X					X	X	X	X	X					X	X	
309SAC	Salinas River, Chualar	X	X	X	X	X	X	X	X	X	X	X						X	
309QUI	Quail Creek at Highway 101	(2)					(2)			(2)									
309GRN	Salinas Riv, Greenfield	X	X	X	X	X	X	X	X	X	X	X	X		X			X	
309SAG	Salinas Riv, Gonzales	X	X	X	X	X	X	X	X	X	X	X	X		X			X	
309CRR	Chualar Creek at Chualar River Road	(2)					(2)			(2)									
	ESTERO BAY HYDROLOGIC UNIT																		
310CCC	Chorro Creek	X	X			X	X	X	X	X	X	X	X	X	X		X	X	
310WRP	Warden Creek		X			X	X	X	X		X		X		X			X	
310SLD	Davenport Creek	X	X			X	X	X	X	X					X			X	
310PRE	Prefumo Creek	X	X			X	X	X	X	X		X	X		X		X	X	
310USG	Arroyo Grande Creek, downstream	X	X		X	X	X	X	X	X	X	X			X		X	X	
310LBC	Los Berros Creek	X	X			X	X	X	X	X		X			X			X	
	SANTA MARIA HYDROLOGIC UNIT																		
312OFC	Oso Flaco Creek	X	X			X	X	X	X		X			X	X		X	X	
312OFN	Oso Flaco Creek	X	X			X	X	X	X		X			X	X		X	X	
312SMA	Santa Maria River Estuary					X	X	X	X		X	X	X	X	X	X		X	X
312SMI	Santa Maria River	X	X		X	X	X	X	X	X	X	X			X		X	X	
312BCC	Bradley Canyon Creek	(2)					(2)			(2)									
312BCJ	Bradley Channel at Jones Street	(2)					(2)			(2)									
312GVS	Green Valley at Simas	(2)					(2)			(2)									

CMP Site ID	Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	COMM	SHELL
		Beneficial Use Codes[1]																	
312MSD	Main Street Canal u/s Ray Road	(2)					(2)				(2)								
312ORC	Orcutt Creek	X	X			X	X	X	X	X					X	X	X	X	
312ORI	Orcutt Creek	X	X			X	X	X	X	X					X	X	X	X	
	SANTA YNEZ HYDROLOGIC UNIT																		
314SYL	Santa Ynez River, downstream	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	
314SYF	Santa Ynez River, downstream	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	
314SYN	Santa Ynez River, downstream	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	
	SOUTH COAST HYDROLOGIC UNIT																		
315GAN	Glen Annie Creek	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	
315APF	Arroyo Paredon	X	X			X	X	X	X		X	X	X		X	X	X	X	
315FMV	Franklin Creek	X	X			X	X	X	X	X	X	X	X		X		X	X	
315BEF	Bell Creek at Winchester Canyon Park	(2)					(2)				(2)								

Table Notes:

(1) Key to Beneficial Use Codes in Table 2-2

Code	Beneficial Use	Code	Beneficial Use
MUN	Municipal and Domestic Supply	SPWN	Spawning, Reproduction, and/or Early Development
AGR	Agricultural Supply	BIOL	Preservation of Biological Habitats of Special Significance
PRO	Industrial Process Supply	RARE	Rare, Threatened, or Endangered Species
IND	Industrial Service Supply	EST	Estuarine Habitat
GWR	Ground Water Recharge	FRESH	Freshwater Replenishment
REC1	Water Contact Recreation	NAV	Navigation
REC2	Non-Contact Water Recreation	POW	Hydropower Generation
WILD	Wildlife Habitat	COMM	Commercial and Sport Fishing
COLD	Cold Fresh Water Habitat	AQUA	Aquaculture
WARM	Warm Fresh Water Habitat	SAL	Inland Saline Water Habitat
MIGR	Migration of Aquatic Organisms	SHELL	Shellfish Harvesting

(2) These waterbodies do not have beneficial uses specifically designated, hence, the Region 3 Basin Plan (Basin Plan table 2-1)provides that these surface water are assigned the following designations: Municipal and Domestic Water Supply (MUN), and protection of recreation and aquatic life uses. The water quality objectives associated with these uses are therefore applicable in these water bodies. The Basin Plan also assigns specific numeric water quality objectives to all water bodies for pH, unionized ammonia, and minimum dissolved oxygen (and saturation) that are consistent with the WARM beneficial use: “For waters not mentioned by a specific beneficial use, dissolved oxygen concentration shall not be reduced below 5.0 mg/l at any time.” (Page III-4, *Water Quality Control Plan For The Central Coast*).

Table 2-3. Objectives from the Central Coast Basin Plan for CMP parameters and related beneficial uses.

Parameters Monitored	Beneficial Uses: Municipal and Domestic Water Supply	Agricultural Water Supply	Non-Contact Recreation	Contact Recreation	Commercial and Sport Fishing	Freshwater Habitat and Aquatic Life	Spawning	Fish Migration	wildlife Habitat and Uses
Physical and Chemical Parameters in Water									
Nitrate, mg/L as N	< 10	Var.[1]	—	—	—	Narr[2]	—	—	—
Ammonia, mg/L as N	—	Var.	—	—	—	—	—	—	—
Unionized ammonia, mg/L as N	—		—	—	—	< 0.025	—	—	—
Orthophosphate, mg/L as P	—	—	—	—	—	Narr	—	—	—
Total Dissolved Solids (TDS), mg/L	—	Site-specific	—	—	—	—	—	—	—
Conductivity, µS/cm	—	Var.	—	—	—	—	—	—	—
Turbidity, NTU	Narr	—	Narr	—	—	Narr	Narr	—	—
Temperature, celsius	—	—	—	—	—	Narr	Narr	Narr	—
Dissolved Oxygen, mg/L	—	—	—	—	—	5 (WARM) 7 (COLD)			—
Dissolved Oxygen Saturation (median), %	—	—	—	—	—	85%	—	—	—
pH, $-\log[H^+]$	6.5-8.3	—	—	6.5-8.3	—	7-8.5	—	—	—
Chlorophyll-a, ug/L	Narr.	—	Narr.	—	—	Narr.	—	—	Narr.
Flow, cfs	Narr.	Narr.	Narr.	Narr.	Narr.	Narr.	Narr.	Narr.	Narr.
Pesticides in Water									
Organophosphate pesticides, ng/L	—	—	—	—	—	Various numeric and narrative objectives	—	—	—
Aquatic Toxicity									
Invertebrate species (Mortality and Reproduction)	—	—	—	—	—	Narr.	—	—	—
Fish species (Mortality and Growth)	—	—	—	—	—	Narr.	—	—	—
Algae species (Cell Density)	—	—	—	—	—	Narr.	—	—	—
Sediment Toxicity									
Invertebrate species (Mortality and Growth)	—	—	—	—	—	Narr.	—	—	—

Table Notes: "—" indicates no related objective for this parameter.

1 "Var." indicates these objectives for AGR are not specifically defined, and are cited in Basin Plan as concentrations corresponding to "no problems", "increasing problems" and "severe problems".

2 "Narr" indicates Basin Plan objective is narrative, e.g., "no toxic contaminants in toxic amounts"

3 WATER QUALITY MONITORING RESULTS

The results of CMP water quality monitoring discussed in this report include:

- Summary of field and laboratory quality control results and qualified data
- Summary of overall data quality and completeness
- Standard summary statistics are provided for each site and parameter in Appendix A. For each water quality parameter evaluated, the following statistics were calculated: Total number of measurements (*n*); Minimum detected value (*min detected*); Maximum detected value (*max detected*); Arithmetic average (*mean*); Standard Deviation (*Std Dev*).
- Table of relevant numeric water quality objectives (Table 3-1. Site-specific Basin Plan objectives for CMP monitoring sites).
- Compliance frequencies with relevant water quality objectives are discussed for each hydrologic unit, and are provided for individual sites along with the summary statistics in Appendix A.

Results are organized by surface water hydrologic units, and significant spatial patterns and comparisons to water quality objectives are discussed. Concentrations of monitored parameters were compared between sites and to applicable water quality objectives. Results are also discussed relative to other CMP sites within the hydrologic unit. Statistically significant changes over time ("trends") are illustrated with bar graphs in Appendix B and data are also illustrated as time series plots in Appendix C.

Broad seasonal patterns and regional spatial comparisons are discussed for all hydrologic regions in Section 4.

3.1 QUALITY ASSURANCE SUMMARY

Chemistry data collected for the CMP were evaluated for precision, accuracy, and completeness as required by the CMP QAPP (Revision 9). In general, the precision and accuracy of the majority of CMP monitoring chemistry results meet the CMP data quality objectives (DQOs), with the primary issues being related to sample matrix effects (*i.e.*, MS/MSD percent recoveries and relative percent differences). Additionally, the following analytical issues were addressed:

1) The frequency of concentration inversions between dissolved orthophosphate and total phosphate became an issue. Since two separate laboratories (Physis and FGL) were used to analyze dissolved orthophosphate and total phosphorus, respectively, it was impossible to determine which values were correct. As a result, it was determined that using a single laboratory (FGL) and having them review all dissolved orthophosphate and total phosphorus data prior to reporting would be the best solution going forward.

2) Due to a change in staffing and lack of training, laboratory duplicates were absent from several analytes monitored during the Third Quarter. The laboratory promised to improve their communication and training protocols.

There were no other systematic analytical problems for data collected in 2014 and the data generated are adequate for the purposes of the CMP monitoring program.

Of the 3,542 primary environmental analytical chemistry results generated by the CMP between January and December 2014, 1,569 results required qualification, resulting in 55.7% valid and unqualified data with no restrictions on use. Of the 1,569 total qualified chemistry data:

- 28 results were qualified as “CE” due to a lack of sample homogeneity,
- 246 results were qualified as “VFDP/FDP” due to field duplicate Relative Percent Difference (RPD) values being above the QC limit. The following Corrective Actions were undertaken:
    - Original site was moved to a stretch of the stream where TSS appeared to be more representative of the stream. The original site had high TSS levels, which made it difficult for the field team to collect homogeneous samples.
    - TSS collection technique was changed from a bucket grab to simultaneously filling replicate sample bottles directly from the stream.

  These modifications reduced the incidence of qualified data from a high of 12 percent in the second quarter to just 1 percent in quarters three and four of the year.
- 598 results were qualified as “VIL” due to Matrix Spike/Matrix Spike Duplicate (MS/MSD) RPDs that were outside control limits. The following Corrective Actions were taken:
    - Contacted the laboratory responsible for the majority of the MS/MSD RPD control issues to find out why there was a significant increase in the number of matrix-related qualified data between 2013 and 2014 from samples collected at the same locations. The laboratory is currently investigating.
- 38 results were qualified as “JA” due to the analyte being positively detected but not quantified,
- 1,200 results were qualified as “VGB” due to MS/MSD percent recoveries being outside control limits. The following Corrective Actions were taken:
    - Contacted the laboratory responsible for the majority of the MS/MSD RPD control issues to find out why there was a significant increase in the number of matrix-related qualified data between 2013 and 2014 from samples collected at the same locations. The laboratory is currently investigating.
- 9 results were qualified as “VBY” due to elevated sample temperatures upon arrival at the laboratory,
- 1 result was qualified as “VBZ” due to improper sample preservation,
- 26 results were qualified as “VIP” due to the analyte being detected in the field or laboratory generated blank samples, and
- 10 results were qualified as “VH” due to holding time exceedances.

Several results received multiple qualifications, therefore the above qualifier counts are not additive.

Aquatic toxicity data were evaluated for precision, accuracy and completeness as required in the CMP QAPP. The toxicity data generated are adequate for the purposes of the CMP monitoring program. Of the 881 results in the record, 19 were qualified as “H” due to holding time violations caused by having to re-test the samples.

Habitat data collected for the CMP were evaluated for completeness as required by the CMP QAPP. In general, the CMP monitoring habitat results meet the CMP data quality objectives (DQOs) for completeness, with 88.9% of the data being unqualified. Of the data that were qualified, all were the result of sites that were unable to be sampled due to the following issues:

- 28 results were qualified as “FIA” due to the sample location being inaccessible,
- 116 results were qualified as “FDS” due to the site being dry,
- 635 results were qualified as “FDR” due to disconnected/non-continuous flows,
- 10 results were qualified as “FTD” because the location was too deep to be measured, and
- 5 results were qualified as “FTT” because the water was too turbid for measurement.

Field data collected for the CMP were evaluated for accuracy and completeness as required by the CMP QAPP. Approximately 5% of the field data were qualified due to the following:

- 5 results were qualified as “CJ” due to sample concentrations that were outside of the instrument calibration range,
- 19 results were qualified as “FDS” due to the site being dry,
- 132 results were qualified as “FDR” due to disconnected/non-continuous flows,
- 20 results were qualified as “FIA” due to inaccessible sample locations,
- 46 results were qualified as “FIF” due to instrument or probe failure, and
- 6 results were qualified as “HT” because the values were calculated using results from associated tests.

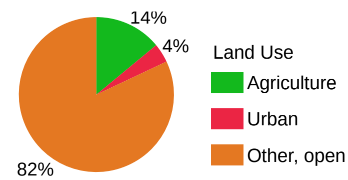
The objectives for completeness are intended to apply to the monitoring program as a whole. All 12 planned water monitoring events were successfully conducted, with a total of 430 of 607 planned site visits resulting in samples being collected, resulting in a 71% sampling success rate. The reasons for each of the 177 site visits not resulting in samples being collected are presented below:

- 61 (Dry channel),
- 112 (Disconnected pools/discontinuous flows), and
- 2 (Access temporarily denied).

All of the collected samples were analyzed, for an overall analytical completion rate of 100%, which exceeds the completeness goal for the CMP.

3.2 PAJARO RIVER HYDROLOGIC UNIT (HU 305)

Descriptions of the Pajaro Hydrologic Unit are summarized from the CCRWQCB's *Pajaro River Watershed Characterization Report* (CCRWQCB 2003). The Pajaro River watershed encompasses over 1,300 square miles in parts of four counties of central coastal California: San Benito, Santa Clara, Santa Cruz, and Monterey Counties. There are five incorporated cities within the watershed: Watsonville, Gilroy, Morgan Hill, Hollister, and San Juan Bautista. Major tributaries to the Pajaro River include San Benito River, Tequisquita Slough, Pacheco Creek, San Juan Creek, Watsonville Slough, Llagas Creek, Uvas Creek, Miller Canal, and Corralitos Creek. Pajaro River watershed flow patterns are generally characteristic of a Mediterranean climate, with higher flows during the wetter, cooler winter months and low flows during the warmer, drier summer months. Principal water sources for the Pajaro River and its tributaries are surface runoff, springs, subsurface flow into the channels, and reclaimed wastewater entering the watershed through percolation from water discharged by South County Regional Wastewater Authority (SCRWA). The first three water sources are subject to large flow variations due to climatic influences, while the discharge from the SCWRA tends to influence flow year-round. In past years the Pajaro watershed has also received water from the San Felipe Division of the Central Valley Project (CVP), which delivered CVP water to the San Justo Reservoir and directly to agricultural and rural users in San Benito County, and to the Hollister and San Juan Bautista area for municipal use. This water also made its way indirectly into the Pajaro River and its tributaries as agricultural return flows and sub-surface drainage, however due to the ongoing drought there was zero agricultural allocation from the San Felipe system in 2014.



The Pajaro River watershed contains a wide variety of land uses, including row crop agriculture, livestock grazing, forestry, industrial, and rural/urban residential. The watershed also contains significant amounts of undeveloped natural vegetative cover, which provides habitat to numerous native bird and wildlife species.

There were originally ten core CMP sites in the Pajaro River hydrologic unit. These included the mainstem Pajaro River at Main St. in Watsonville (305PJP) and at Chittenden (305CHI), with the rest of the sites located on tributary water bodies: Miller Canal (305FRA), San Juan Creek (305SJA), Tequisquita Slough (305TSR), Llagas Creek (305LCS), Carnadero Creek (305CAN), Salsipuedes Creek (305COR), Watsonville Slough (305WSA), and Struve Slough (305STL).

In 2012 the Struve Slough (305STL) site was removed from the program due to lack of impairment and agricultural influence, and three additional sites were added: Watsonville Creek (305WCS), the Beach Road Ditch (305BRS), and Furlong Creek (305FUF). The three new sites are also monitored by other programs, and so direct monitoring by the CMP during the 2012-2016 Waiver period took place only during the supplemental chemistry events in 2014. Data for 2012-2013 were derived from the Pajaro Valley Water Management Agency (PVWMA, sites 305WCS and 305BRS) and Central Coast Ambient Monitoring Program (CCAMP, site 305FUF). Both other programs have comparable quality assurance plans to the CMP and monitor overlapping suites of parameters and events.

Pajaro watershed sites are grouped near the Watsonville area in the lower portion of the watershed (305WSA, 305WCS, 305BRS, 305PJP, and 305COR), and southeast of Gilroy in the upper watershed (305LCS, 305CAN, 305FRA, 305TSR, 305CHI, and 305FUF).

The beneficial uses designated by the Basin Plan for water bodies monitored by the CMP in the Pajaro River region include nearly every beneficial use, with the exceptions being industrial process supply, navigation, hydropower generation, aquaculture, and inland saline habitat (Table 2-2). Two water bodies monitored by the CMP are not listed in Table 2-1 of the Basin Plan – the Miller Canal and San Juan Creek (305FRA and 305SJA) – and are thus assigned the following designations: Municipal and Domestic Water Supply, and protection of both recreation and aquatic life uses.

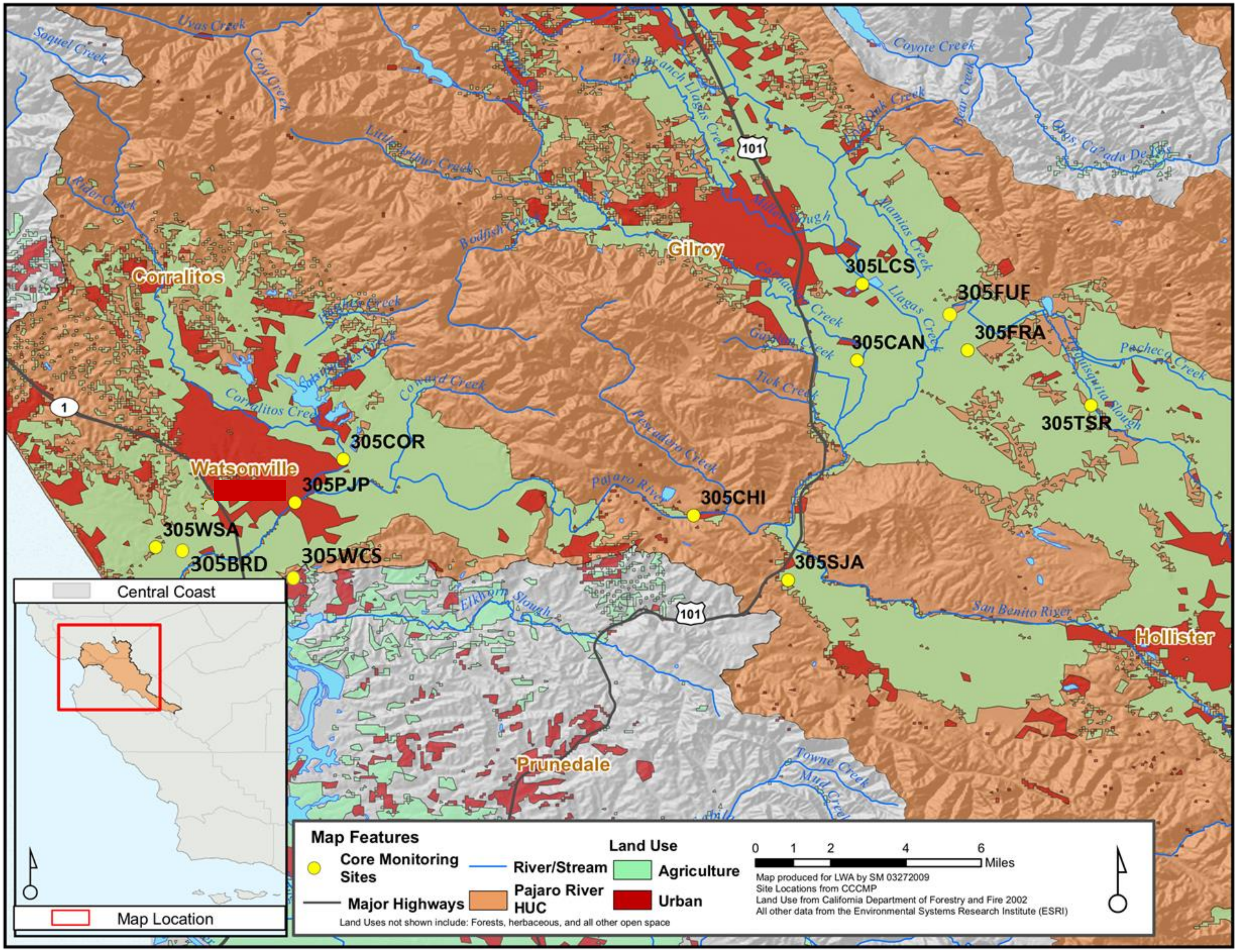


Figure 3-1. CMP core monitoring sites and distribution of major land uses in the Pajaro River Hydrologic Unit

3.2.1 Flow Results

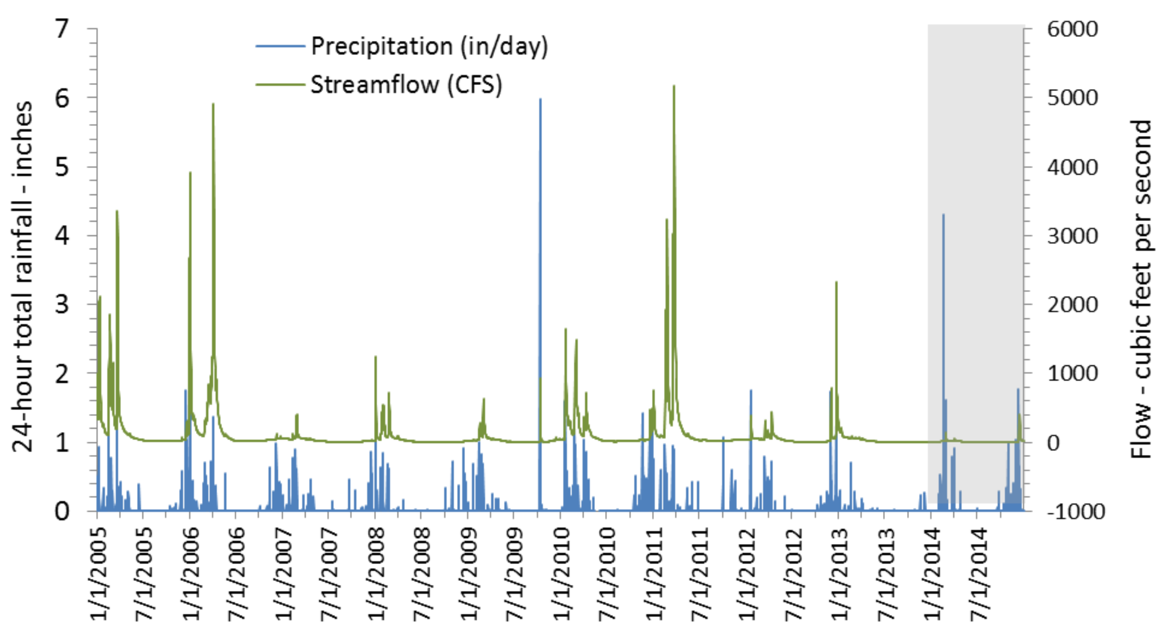
Seasonal patterns for the Pajaro River region are characterized by precipitation that occurs primarily from January through April. Flows typically decrease rapidly in May and historical average flows at Chittenden are less than 40 cfs from June through November (USGS 2008). The total precipitation reported for 2014 was about five times the accumulation reported in 2013 and actually exceeded that of 2011, however flows at the USGS gauge at Chittenden remained depressed throughout 2014 as compared to historic flows (Figure 3-2).

Flows measured by the CMP in 2014 ranged from dry season flows of 0 CFS (or even slight reverse-direction flows due to wind) in some sites, up to 32 and 31 CFS in the Miller Canal and mainstem Pajaro at Main Street respectively in March. Reverse-direction flows were reported in the mainstem river at Chittenden in October and November, which is not typical of the site – water typically moves with a measurable downstream velocity there. No flows over 20 CFS were measured by the CMP at Chittenden in 2014, which is also not typical of the site. Flows were generally elevated from January through May, although at many sites the elevated flows tapered off earlier, by March or April. The return of elevated flows typically observed in this hydrologic unit in December only occurred at some sites in 2014 (having not occurred at all in 2013), and flows were low throughout the rest of the year. Median flows at all sites were less than 2 CFS. In years past it was not possible to measure flow in the Watsonville Slough near San Andreas Rd due to standing water conditions created by operation (closure) of tide gates further downstream at Shell Rd. In 2014 however, CMP field crews were able to measure low flows there in January and February (0.15 – 2.7 CFS), and the site had standing/ponded conditions from May through December.

Trends in streamflow detected in the Pajaro hydrologic unit from 2006 through 2013 were entirely in the direction of declining flows. The 2014 monitoring results generally show that pattern continuing.

Figure 3-2. Pajaro River regional precipitation and flow patterns, Pajaro River at Chittenden

Precipitation data acquired from the California Irrigation Management Information System (CIMIS) at http://www.cimis.water.ca.gov/cimis. Historical average flows at Chittenden acquired from USGS National Water Information System (http://nwis.waterdata.usgs.gov).



3.2.2 Turbidity Results

There is currently no numeric water quality objective for turbidity in the Central Coast Basin Plan. Relative to each other however, Pajaro monitoring sites exhibited substantial differences in turbidity:

- Average turbidities were lowest (4 NTU) in Llagas Creek, and median turbidities around 4 NTU were also observed in Salsipuedes Creek, Watsonville Creek, and in the Pajaro River at Main Street (305PJP).
- The highest average turbidity was observed in the Beach Rd. Ditch (87 NTU), where turbidities were elevated about a third of the time. Turbidities were also frequently elevated in Furlong Creek (62 NTU average) and in the Tequisquita Slough (64 NTU).
- Turbidity at mainstem river sites was not markedly different than in the tributaries, with averages in the middle of the range of results for all Pajaro region sites.

Trends in turbidity detected in the Pajaro hydrologic unit from 2006 through 2013 were entirely in the direction of declining turbidities. The 2014 monitoring results generally show a continued pattern of reduced turbidity relative to early years of the CMP, and/or similar turbidity results to 2013.

3.2.3 Nutrient Results

Total ammonia concentrations were largely undetected at Pajaro sites in 2014. Concentrations were highest in Beach Rd. Ditch (0.07 mg/L average and 0.29 mg/L maximum) in the lower watershed and in San Juan Creek (0.2 mg/L average and 1.29 mg/L maximum) in the upper watershed. The lowest average concentrations were in Watsonville Slough (0.04 mg/L, not-detected) and Watsonville Creek (0.04 mg/L, not-detected) . A total ammonia objective to protect agricultural uses applies at two mainstem sites and two tributary sites (Salsipuedes Creek and Llagas Creek). This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems."

Average unionized ammonia concentrations were highest in San Juan Creek (0.005mg/L). Many sites had low average concentrations. Exceedances of the Basin Plan objective of 0.025 mg/L for protection of aquatic life occurred only once, in San Juan Creek in May at 0.03 mg/L.

Average nitrate concentrations were low at five of the Pajaro region sites in 2014. Salsipuedes Creek (1.1 mg/L), Miller's Canal (0.1 mg/L), and Tequisquita Slough (0.3 mg/L) were low in nitrate, similar to prior years. Also low in 2014 were the Pajaro River at Main St. (4.5 mg/L), and Llagas Creek (5.0 mg/L). Average nitrate concentrations were highest in San Juan Creek (22 mg/L), Watsonville Creek (23 mg/L) and Furlong Creek (28 mg/L). Nitrate levels were also elevated in the Watsonville Slough during the two monitoring events in which there was water in the creek. The 10 mg/L Basin Plan objective for nitrate to protect municipal and domestic supply applied to seven water bodies – San Juan Creek, Carnadero/Uvas Creek, Llagas Creek, Salsipuedes Creek, Millers Canal, and the two mainstem Pajaro River sites. The objective was exceeded in every sample from Carnadero and Furlong Creeks, and in all but one sample from Watsonville Creek. A nitrate objective to protect agricultural uses also applies at four Pajaro watershed sites - Llagas Creek, Salsipuedes Creek and the mainstem Pajaro River sites. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems". Because the objective for nitrate to protect municipal and domestic supply is more specific, it was used to assess exceedances.

Patterns in total nitrogen concentrations were identical to those for nitrate in 2014. Organic N almost always comprised at least half of the Kjeldahl nitrogen, and most typically accounted for 60-90%. Lower percentages of organic N typically corresponded to events with higher ammonia concentrations.

Average orthophosphate concentrations were highest in the Watsonville Slough (305WSA, 1.81 mg/L based on only two events with water), and Beach Rd. Ditch (305BRD, 0.8 mg/L). The lowest average concentrations were observed in Carnadero Creek (305CAN, 0.06 mg/L), with several sites having average concentrations around 0.2 mg/L. There is currently no numeric water quality objective for orthophosphate in the Central Coast Basin Plan. Spatial patterns in total phosphorus concentrations were similar to those for orthophosphate in 2014.

Trends in inorganic nutrients detected in the Pajaro hydrologic unit from 2006 through 2013 were mixed, with some declining ammonia concentrations during wet events and several declining nitrate cocentrations, but also several notable increasing trends in ammonia, nitrate, and orthophosphate. The 2014 monitoring results generally showed results comparable to 2013, upholding the trends. The new sites at Beach Rd., Furlong Creek, and Watsonville Creek did not have a sufficient history of monitoring results to address trends.

3.2.4 Conductivity, Dissolved Solids, and Salinity

Average conductivities ranged from 793 to 9087 µS/cm in the Pajaro region in 2014. The highest average conductivities were observed in Beach Rd. Ditch (9088 µS/cm) and San Juan Creek (5018 µS/cm). A conductivity objective to protect agricultural uses also applies to four Pajaro watershed sites - Llagas Creek, Salsipuedes Creek and the mainstem Pajaro River. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems". No site had an average conductivity below 750 µS/cm in 2014, but Salsipuedes Creek was again the lowest conductivity site with a 793 µS/cm average.

The spatial distribution of relative TDS and salinity concentrations was the same as for patterns in conductivity. No CMP sites in the Pajaro hydrologic unit have applicable numeric TDS objectives from the Basin Plan, and there are no applicable numeric objectives in the Basin Plan for salinity.

Trends in salinity-related parameters detected in the Pajaro hydrologic unit from 2006 through 2013 were entirely in the direction of increasing salinity, conductivity, and TDS. The 2014 monitoring results were similar to results from 2013, though even more elevated in several cases (i.e. conductivity at both the highest and lowest average conductivity sites were higher in 2014 than in 2013).

3.2.5 Toxicity Results

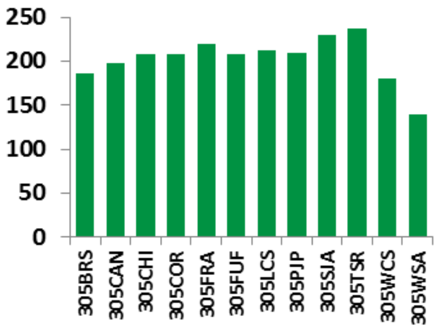
For aquatic toxicity samples collected in the Pajaro region, the proportions of toxic samples are illustrated in Figure 3-3. Pesticides were also analyzed by the CMP in Pajaro region samples during the 2014 monitoring period, and are discussed in a separate report containing all supplemental chemistry data for both the NMU and SMU.

During 2014, there was no observed toxicity to algae and almost no toxicity to fish in the Pajaro hydrologic unit. Many samples exhibited algal growth rates much higher than the control. The only toxicity to fish was observed in Watsonville Creek in February (Growth rate 85% of control).

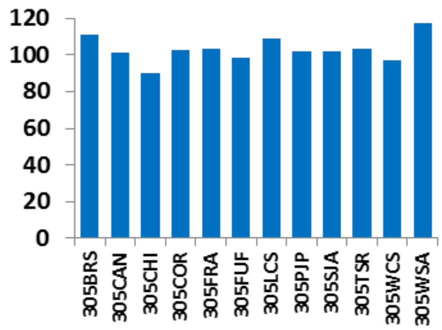
Two toxicity samples showed mortality for invertebrates in water in the Pajaro unit in 2014 (Pajaro River at Main St. in August and Watsonville Creek in December), however several samples throughout the year showed reduced reproduction rates (Beach Rd. Ditch, Miller Canal, Pajaro at Main St. and Watsonville Creek). Sediment samples from the Miller Canal, Furlong Creek, Tequisquita Slough, and San Juan Creek showed moderate but significant invertebrate mortality, and the samples from Salsipuedes Creek, Watsonville Creek, and the Pajaro River at Main St. showed moderate but significant reductions in growth rates. Sediment samples from Carnadero Creek, the Pajaro River at Chittenden, and the Beach Road Ditch did not show sediment toxicity in 2014.

Figure 3-3. Results for aquatic toxicity (water and sediment) monitoring in Pajaro region

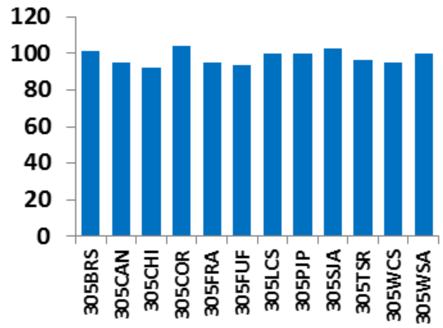
Bars represent the average survival, reproduction, or growth rate for all 2014 samples at each site, as compared to ("percent of") laboratory controls. There are 4 water toxicity sampling events (including algae, fish, and invertebrates), and 1 sediment toxicity sampling event at each site, each year.



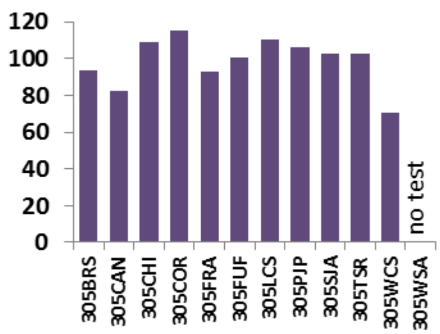
a) Algae toxicity in water - growth



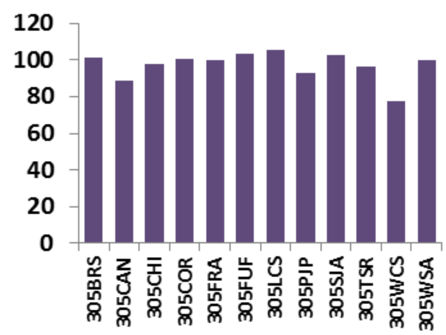
b) Fish toxicity in water - growth



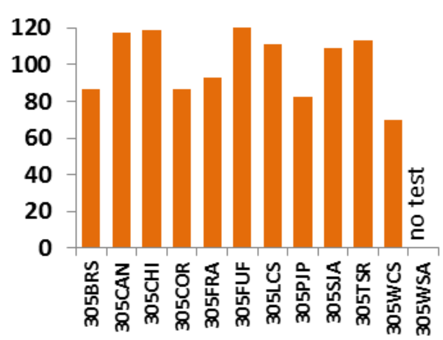
c) Fish toxicity in water - survival



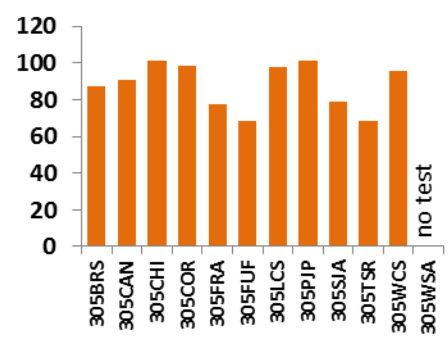
d) Invertebrate toxicity in water - reproduction



e) Invertebrate toxicity in water – survival



f) Invertebrate toxicity in sediment - growth



g) Invertebrate toxicity in sediment - survival

The 2014 toxicity monitoring results uphold temporal patterns noted in 2012 and 2013 particularly for reduced or absent toxicity to algae and fish. Slightly more incidences of toxicity to invertebrates were observed in the Pajaro hydrologic unit in 2014 than for the 2012 and 2013 monitoring years, thus weakening the pattern of reduced toxicity to invertebrates previously observed.

3.2.6 Other Parameters of Concern

Based on exceedances of Basin Plan objectives observed in CMP results, dissolved oxygen and pH may also be parameters of concern at several sites in the Pajaro River region. Only Watsonville Creek and San Juan Creek met dissolved oxygen concentration objectives in all samples from 2014. The other five sites however had at least one sample with dissolved oxygen concentration below the 7 mg/L minimum objective for cold water aquatic life, with most having three or more. No site met the 85% minimum dissolved oxygen saturation objective in all 2014 samples. Because San Juan Creek is not specifically listed in Table 2-1 of the Basin Plan, the Basin Plan specifies a general numeric objective whereby the dissolved oxygen objective for this water body must be at least 5 mg/L with median saturation percentage greater than 85%, based on assumed beneficial uses of MUN, REC, and aquatic life[1]. San Juan Creek met the 5 mg/L minimum dissolved oxygen limit for concentration in all 2014 samples, and the median oxygen saturation was 90% despite two samples with individual saturations below 85%.

In 2014 only five sites had exceedances of pH objectives – the Beach Rd. Ditch, Miller Canal, Tequisquita Slough and Watsonville Creek had pH greater than 8.3, while Llagas Creek had pH less than 7.0. The mainstem river sites and five of the tributaries had no pH exceedances in 2014.

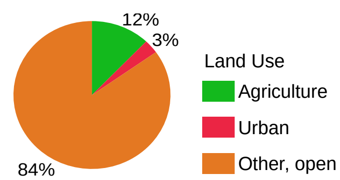
In 2013 several declining trends in pH were noted, and there were a few dissolved oxygen trends in both directions that were difficult to interpret. The 2014 monitoring results generally uphold the temporal patterns in pH, with reduced exceedance percentages in Salsipuedes Creek, Miller Canal, and Tequisquita Slough. Past "exceedances" in Llagas Creek have been results below the 7 pH unit threshold, and following the declining trend there was a greater percentage of low-pH results in Llagas Creek in 2014 than in 2013.

[1] For water bodies without beneficial uses designated in Table 2-1 of the Basin Plan, the Basin Plan specifies they are assigned the water quality objectives associated with Municipal and Domestic Water Supply, and protection of both recreation and aquatic life uses. These include specific numeric objectives for pH, unionized ammonia, and the following for dissolved oxygen, "For waters not mentioned by a specific beneficial use, dissolved oxygen concentration shall not be reduced below 5.0 mg/l at any time. Median values should not fall below 85 percent saturation as a result of controllable water quality conditions." (Page III-4, *Water Quality Control Plan For The Central Coast*).

SALINAS RIVER HYDROLOGIC UNIT (HU 309)

Descriptions of the Salinas River Hydrologic Unit hydrology are summarized from the CCRWQCB's *Salinas River Watershed Characterization Report* (CCRWQCB 2000). The watershed of the Salinas River and its tributaries covers approximately 4,600 square miles (nearly 3 million acres) and lies within San Luis Obispo and Monterey Counties. The Salinas River, which originates in San Luis Obispo County, flows northwestward into Monterey County, through the entire length of the Salinas Valley and empties into Monterey Bay. The watershed's main tributaries are the Arroyo Seco, Nacimiento, San Antonio, and Estrella Rivers. The Salinas River drains a large watershed with a number of distinct tributaries; and although it is considered a single hydrologic unit, geographic, political, land use and ground water divisions facilitate discussion of the Salinas River watershed in terms of an upper and a lower watershed. The upper watershed begins at the headwaters of the Salinas River in the La Panza Range southeast of Santa Margarita Lake in San Luis Obispo County and flows to the narrows area near Bradley, just inside Monterey County. The upper watershed includes drainages of the Estrella, Nacimiento and San Antonio Rivers, overlies the Paso Robles Ground Water Basin and lies mainly in San Luis Obispo County. The lower watershed extends from the Bradley narrows area to Monterey Bay and includes the drainage of the Arroyo Seco River, overlies the Salinas Ground Water Basin, and is entirely within Monterey County.

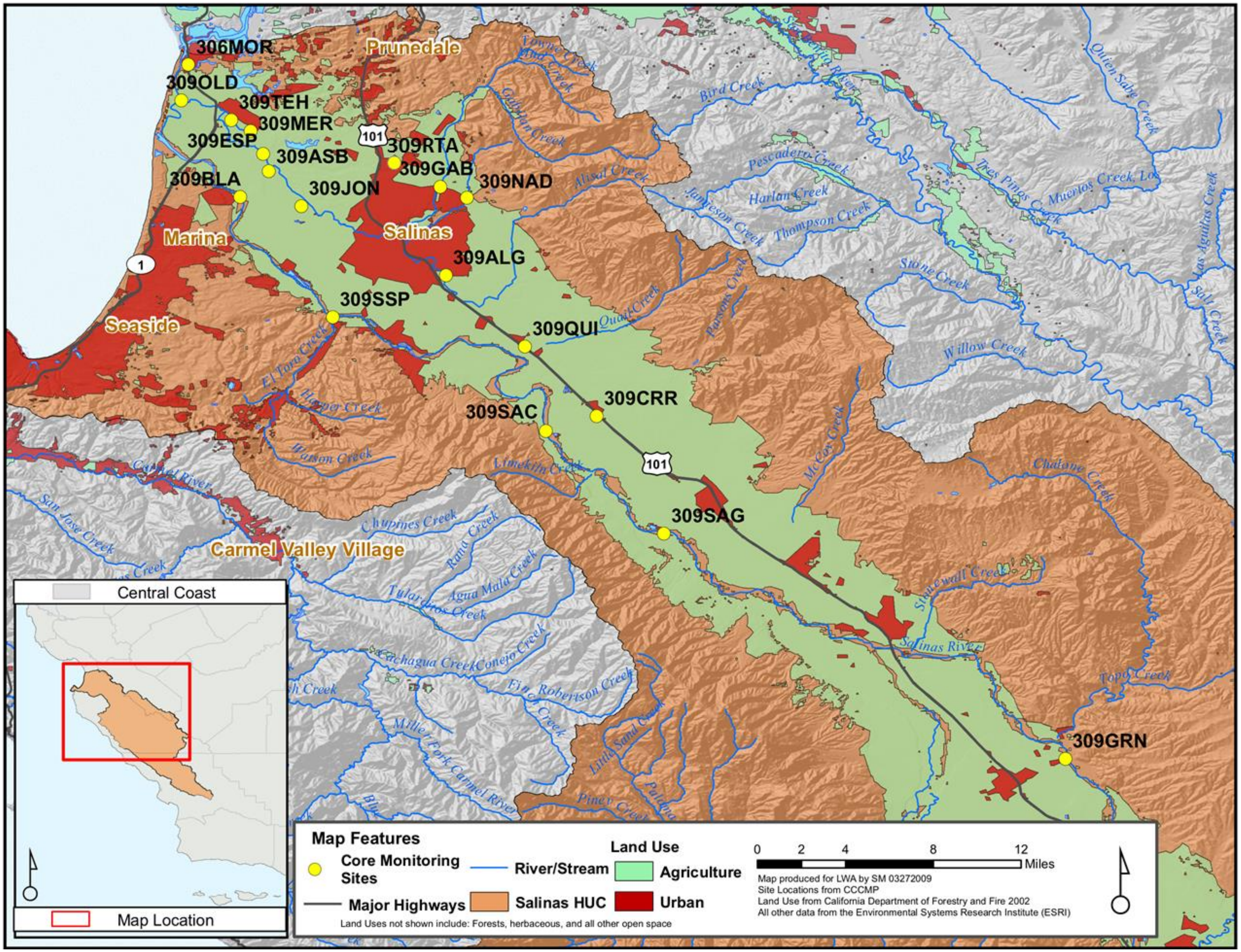
The Salinas Reclamation Canal parallels the Salinas River in the lower watershed, also ultimately draining to Monterey Bay. The Reclamation Canal incorporates drainage from the city of Salinas and surrounding agricultural areas, including several small tributaries which drain the Gabilan foothills to the east. Near Castroville, the Reclamation Canal meets Tembladero Slough and incorporates drainage from the city of Castroville and more western agricultural areas, ultimately flowing to Monterey Bay and the Elkhorn Slough via Moss Landing Harbor.



In addition to agriculture and urban development, other land uses in the Salinas River watershed include two military facilities (Fort Hunter Liggett and Camp Roberts), exploitation of mineral and oil reserves in the San Ardo area and a few other locations throughout the watershed, and some public land and open space.

Historically there have been 17 core CMP sites in the Salinas River hydrologic unit. All of the CMP sites are in the lower watershed below the Bradley Narrows of the Salinas River. There are four sites on the mainstem Salinas River upstream from Salinas at Spreckels, Chualar, Gonzales, and Greenfield (309SSP, 309SAC, 309SAG, and 309GRN) and two sites on tributaries to the river upstream from the city of Salinas: Quail Creek (309QUI), and Chualar Creek (309CRR). There are six sites on tributaries, creeks, and sloughs downstream of Salinas: Moro Cojo Slough (309MOR), Old Salinas River Estuary (309OLD), Tembladero Slough (309TEH), Merrit Ditch (309MER), Espinosa Slough (309ESP), Alisal Slough (309ASB), and Blanco Drain (309BLA). There are two sites on the Salinas Reclamation Canal, at San Jon Road (309JON) downstream of the city and at La Guardia Road (309ALG) upstream of the city, and two sites east of Salinas on direct tributaries to the Reclamation Canal: Gabilan Creek (309GAB) and Natividad Creek (309NAD). Alisal Slough (309ASB) has a connection to the lower end of the Reclamation Canal but is not a tributary. In 2012 an 18th site, Santa Rita Creek (309RTA), was added to be addressed as a CMP water body with the majority of routine monitoring accomplished by existing monitoring activities of the RWQCB's CCAMP program.

Figure 3-4. CMP core monitoring sites and distribution of major land uses in the Salinas River Hydrologic Unit



3.2.7 Flow Results

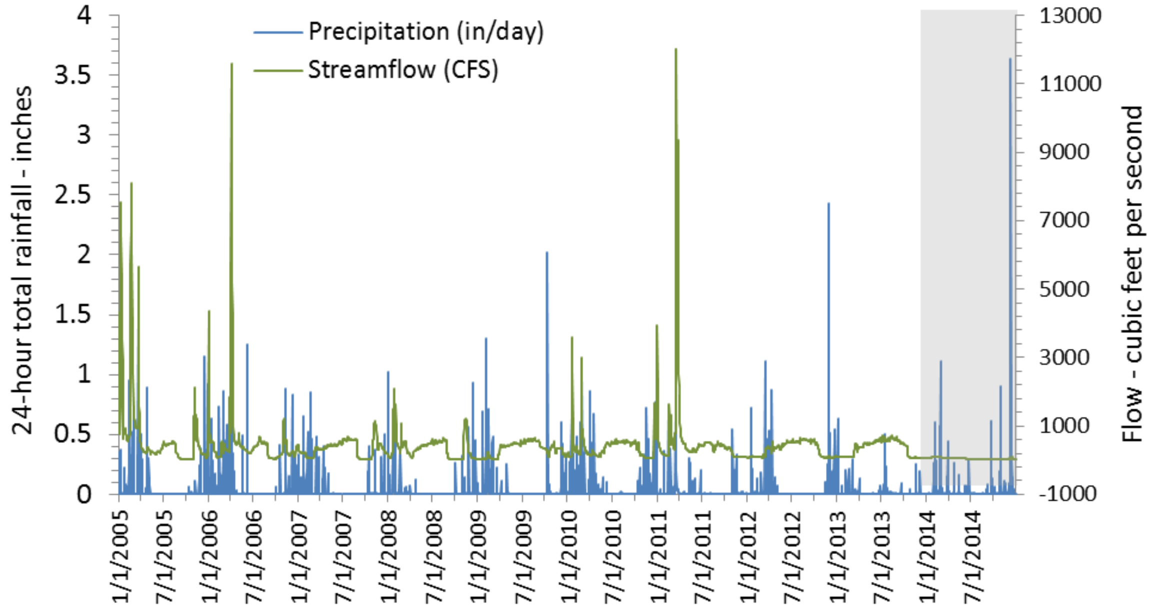
Seasonal patterns for the Salinas River drainage are characterized by precipitation that occurs primarily from November through March. Monthly average flows at Bradley are maintained near 450 CFS for ground water recharge and Salinas Valley Water Project (SVWP) Operations from April through October by releases from Nacimiento and San Antonio Reservoirs. Flow in the Salinas River near Spreckels is maintained at a rate of approximately 20 to 40 cfs when reservoir releases are being made for ground water recharge or SVWP Operations."

Depending on volume and timing of dam releases, flows may progress past Bradley to the King City area, become subterranean, and may then resurface farther downstream. Due to the effect of dam releases followed by groundwater recharge, flows at Bradley generally overestimate flows further downstream in the lower watershed during dry periods. Wet winters such as 2005, 2006, and 2011 generally result in brief periods of very high flow (Figure 3-5). Very high flows have not been observed since 2011, as drought occurred in 2012-2013. Total precipitation in 2014 returned to near normal levels in the lower (northern) watershed, however there was less rainfall in the upper (southern) watershed and the large dam releases which usually drive high flows in the river did not occur. In 2014 the only streamflow measured at any of the CMP's mainstem Salinas River sites occurred in January and February at the Greenfield station, where the highest flow measured was 5.8 CFS. By comparison, maximum flows measured by the CMP at Greenfield in wetter years have been as high as 820 CFS.

Flows measured at other Salinas region CMP sites in 2014 generally reflected higher flows driven by precipitation in the winter and early spring months. Gabilan, Natividad, and Santa Rita Creeks were often dry in summer and fall months of 2014, with extremely low flow conditions common in Chualar Creek, Quail Creek, Alisal Slough, Espinosa Slough, and the Merrit Ditch as well. As in years past, some sites had more consistent, nearly year-round flows. These included the Blanco Drain and Salinas Reclamation Canal, and Tembladero Slough. Moro Cojo Slough and Old Salinas River at Monterey Dunes Way are tidally influenced and can experience "reverse flows" indicated by negative flow rates when tides are high and stream flows are low.

Trends in streamflow detected in the Salinas hydrologic unit from 2006 through 2013 were almost entirely in the direction of declining flows. The 2014 monitoring results generally showed continued depressed flows as compared to earlier years of the CMP, with more "dry" events in the mainstem Salinas River than ever before. The only increasing trend noted in 2013 was at the tidally-influenced site on the Old Salinas River channel. The pattern of increasing flows did not continue in 2014; flows were reduced by all metrics which could indicate an actual change in streamflow or simply a change in the timing of measurement relative to tidal cycles.

Figure 3-5. Salinas Region precipitation and flow patterns, Salinas River at Bradley Precipitation data acquired from the California Irrigation Management Information System (CIMIS) at http://www.cimis.water.ca.gov/cimis. Historical average flows at Bradley acquired from USGS National Water Information System (http://nwis.waterdata.usgs.gov).



3.2.8 Turbidity Results

There is currently no numeric water quality objective for turbidity in the Central Coast Basin Plan. Relative to each other however, Salinas region monitoring sites exhibited substantial differences in turbidity:

- Average turbidities were elevated at nearly every site, with only the Salinas River at Greenfield having truly "low" turbidity (2.4 NTU), followed by Moro Cojo Slough at 19 NTU.
- Average turbidity was also below 100 NTU at three other sites (Alisal Slough, Blanco Drain, and Old Salinas River), with several other sites in the 150 – 450 NTU range.
- The highest average turbidity (2541 NTU) was observed in Santa Rita Creek in 2014. This site had very high turbidity during several monitoring events and was dry the rest of the year. Gabilan Creek results were similar to those for Santa Rita. The south branch of Chualar Creek also had turbidity levels that were notably high in 2014, although not as high as north branch results from prior years.
- Maximum turbidities were observed at virtually all sites during the February monitoring in 2014, with almost all sites showing elevated turbidities in January through March and again in November/December.

Trends in turbidity detected in the Salinas hydrologic unit from 2006 through 2013 were entirely in downward direction. The 2014 monitoring results showed comparable median results between 2013 and 2014 at most sites. Three sites had increased median turbidities relative to 2013 however (Espinosa Slough, Gabilan Creek and Natividad Creek). Most sites had increased average turbidities in 2014 but these were influenced by higher maximum turbidities that are more typical of the sites but were absent in 2013 due to lack of rainfall.

3.2.9 Nutrient Results

Average total ammonia concentrations were highest in Chualar and Natividad Creeks, at 2.1 and 8.2 mg/L. As in years past, the lowest average concentrations were observed in the mainstem Salinas River (at Greenfield, since other mainstem sites were dry). Sites with higher total ammonia concentrations also tended to have highly variable concentrations, with values ranging from "not detected" (<0.08 mg/L) to over 50 mg/L. The total ammonia objective to protect agricultural uses applies to six sites (four mainstem Salinas River sites, Gabilan Creek, and Alisal Slough – 309SSP, 309SAC, 309SAG, 309GRN, 309GAB, and 309ALG). This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems.

The spatial distribution of average unionized ammonia concentrations generally mirrored the pattern of total ammonia. The average concentrations and variability were highest at the same sites mentioned above for total ammonia, and were lowest in the Salinas River at Greenfield. Exceedances of the Basin Plan objective of 0.025 mg/L to protect aquatic life were most frequently observed in the Reclamation Canal above Salinas (half of samples), and in the south branch of Chualar Creek and in Natividad Creek (about a quarter of samples). Exceedances occurred at least once at 7 different sites. It is interesting to note that no exceedances of unionized ammonia objective occurred at any Salinas hydrologic unit site in January, February, or October-December of 2014.

Most of the samples collected in the Salinas hydrologic unit in 2014 exceeded the 10 mg/L objective for nitrate. Average nitrate concentrations for the year exceeded 10 mg/L at all sites except Moro Cojo Slough (0.4 mg/L), Santa Rita Creek (5.7 mg/L), and the Salinas Reclamation Canal below Salinas (9.6 mg/L). Even the mainstem Salinas River at Greenfield had elevated nitrate levels (13.2 mg/L on average). Average nitrate concentrations were highest in the Blanco Drain (63 mg/L), Alisal Slough (309ASB, 46 mg/L), and Tembladero Slough (41 mg/L) in 2014. Natividad Creek also had a high average concentration (47 mg/L), driven by a maximum value of 208 mg/L measured in July. This result was validated, and coincided with very high ammonia and abnormally high salinity parameters as well; streamflow was more or less typical for non-dry conditions in the channel.

The 10 mg/L Basin Plan objective for nitrate as N based on the municipal and domestic supply beneficial use applies to ten sites. The highest exceedance frequencies observed in 2014 were 100% (2 of 2 samples) in the mainstem Salinas River at Greenfield and 91-92% (10 of 11 or 11 of 12 samples). The Alisal Slough and Quail Creek all had 91-92% exceedance rates.

The nitrate objective to protect agricultural uses also applies to six sites (four mainstem Salinas River sites, Gabilan Creek, and Alisal). This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems". Because the objective for nitrate to protect municipal and domestic supply is more specific, it was used to assess exceedances.

Spatial patterns in total nitrogen were generally similar to patterns in nitrate, with the lowest average concentrations in Moro Cojo and Santa Rita Creek and the highest averages in the Blanco Drain, Alisal Slough, Natividad Creek, and Tembladero Slough. The percent of total nitrogen accounted for by nitrate was most typically 80-100%. Notably lower contributions to total nitrogen from the nitrate fraction were observed during some months in Espinosa Slough, the Reclamation Canal downstream of Salinas, Moro Cojo Slough, and Santa Rita Creek. Organic N typically comprised 60% to 100% of the TKN, but the sites with the highest average TKN values were sites that also had higher ammonia levels. One exception to this was the Espinosa Slough, which had one of the highest 2014 average TKN values but was not remarkable in terms of ammonia.

The lowest average orthophosphate concentrations in 2014 were observed in the mainstem Salinas River at Greenfield and in Moro Cojo Slough (0.1 mg/L in both cases). Espinosa Slough, Merrit Ditch, and Blanco Drain also had average orthophosphate concentrations below 0.5 mg/L on average. The highest orthophosphate concentrations in 2014 were in Gabilan Creek (1.0 mg/L average), the Reclamation Canal downstream of Salinas (0.7 mg/L), and in Chualar and Quail Creeks (0.8 mg/L averages). Quail Creek also had the most frequently elevated orthophosphate concentrations above 1.0 mg/L.

Spatial patterns in total phosphorus concentrations were generally similar to those for orthophosphate, with some differences. The Salinas Reclamation Canal downstream of Salinas did not rank as a high average total phosphorus site relative to others in the hydrologic unit, despite doing so for orthophosphate. Conversely, among the highest total phosphorus sites were Espinosa Slough and Santa Rita Creek (which did not rank as high in terms of orthophosphate). There is currently no applicable numeric water quality objective in the Basin Plan for orthophosphate or total phosphorus.

Trends in orthophosphate detected in the Salinas hydrologic unit from 2006 through 2013 were entirely in the increasing direction. There were more increasing than decreasing trends in nitrate, but several notable decreasing trends as well. Ammonia trends were relatively evenly split between increasing and decreasing. The 2014 monitoring results suggest similar conditions at most sites to 2013.

3.2.10 Conductivity, Dissolved Solids, and Salinity

Average conductivity was over 700 µS/cm at all sites, and exceeded 40,000 µS/cm at tidally influenced sites. The highest average conductivities were observed at Moro Cojo Slough and Old Salinas River, which are affected by tidal influences. Only three sites had average conductivities below 1000 µS/cm, including Santa Rita Creek, Gabilan Creek, and the Reclamation Canal upstream of Salinas. The conductivity objective to protect agricultural uses applies to six sites (four mainstem Salinas River sites, Gabilan Creek, and Alisal Slough – 309SSP, 309SAC, 309SAG, 309GRN, 309GAB, and 309ALG). This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining “increasing problems” and “severe problems”.

The relative spatial distributions of TDS and salinity concentrations were identical to the patterns for conductivity. Five sites in the Salinas unit have applicable TDS objectives: all four Salinas River sites (<600 mg/L) and Gabilan Creek (<300 mg/L). This objective is applied as an annual average, and the Salinas River at Greenfield exceeded this in 2014 since the CMP began monitoring there in 2006 (811 mg/L annual average), but this was based on only two monitoring events (January and February) since the site was dry during all other 2014 events. Gabilan Creek exceeded the 300 mg/L objective in 2005, but was only sampled during seven events from 2006 – 2008, due to a lack of flow. It was sampled on three occasions in 2014 and exceeded 300 mg/L during two of them, for an annual average of 476 mg/L. There are currently no applicable numeric objectives in the Basin Plan for salinity.

Trends in salinity-related parameters in the Salinas hydrologic unit from 2006 through 2013 included both increasing and decreasing trends, though the upward trends outnumbered the downward.

3.2.11 Aquatic Toxicity

For aquatic toxicity samples collected in the Salinas River region, proportions of toxic samples are illustrated in Figure 3-6. Toxicity to algae (low growth in sample water relative to a non-toxic control) occurred in only 3 Salinas region samples tested in 2014, all occurring in December. Toxicity to *Selenastrum capricornutum* was observed in December in the Tembladero Slough (68% growth rate), the Reclamation Canal downstream of Salinas (40% growth rate), and the south branch of Chualar Creek (14% growth rate). Most other samples exhibited algae growth rates much higher than in laboratory control samples. Toxicity to fish species (*Pimephales promelas or Cyprinodon variegatus*) was not observed in the Salinas hydrologic unit in 2014.

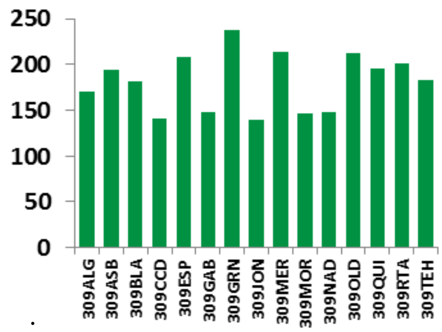
Toxicity to invertebrate species in water was observed in 29 samples tested in 2014, from 13 different sites.   Most of the toxicity involved the mortality endpoint (17 samples), with significant reduction of reproduction observed in an additional 12 samples tested. The five sites which did not show toxicity to invertebrates in water in 2014 included the mainstem Salinas River sites (at Greenfield, Gonzales, Chualar, and Spreckles), and the other was Moro Cojo Slough. Only the Greenfield site on the mainstem river had water to be sampled in 2014, however the other three sites have shown little or no toxicity to invertebrates in other years as well.

Toxicity to invertebrate species in sediment (*Hyalella azteca* or *Eohaustorius estuaris*) was observed in all 11 of the Salinas hydrologic unit monitoring sites that had water during the April, 2014 monitoring event when sediment toxicity sampling was conducted. All samples showed significant mortality. It should be noted that the mainstem Salinas River sites, which tend to have lower toxicity than tributary and Reclamation Canal sites, were not sampled during this event due to lack of water.

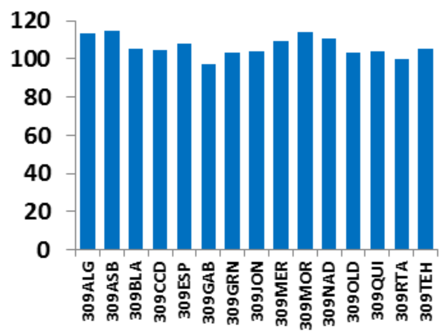
Trends in toxicity-related parameters in the Salinas hydrologic unit from 2006 through 2013 included decreasing trends in toxicity to fish and algae, both of which continued in 2014. Patterns in toxicity to invertebrates in water that were noted in 2012 and 2013 suggested reduced toxicity compared to early years of the program, but this particular trend did not appear to strengthen in 2014. More toxicity to invertebrates in water was observed in 2014 at Salinas sites compared to 2013, and sediment toxicity was similar if not greater in 2014 as well.

Figure 3-6. Results for aquatic toxicity (water and sediment) monitoring in the Salinas region

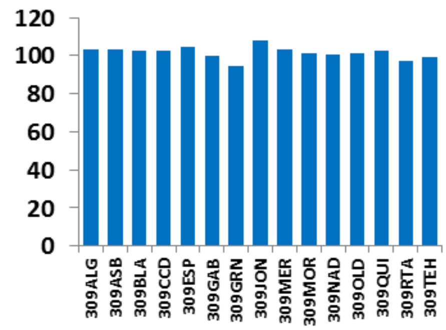
Bars represent the average survival, reproduction, or growth rate for all 2014 samples at each site, as compared to laboratory controls. There are 4 water toxicity sampling events (including algae, fish, and invertebrates), and 1 sediment toxicity sampling event at each site, each year.



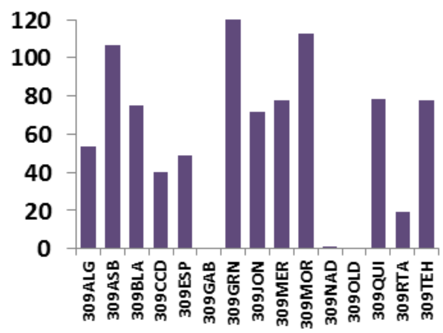
.
a) Algae toxicity in water - growth



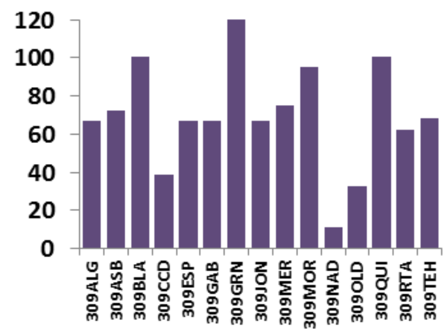
b) Fish toxicity in water - survival



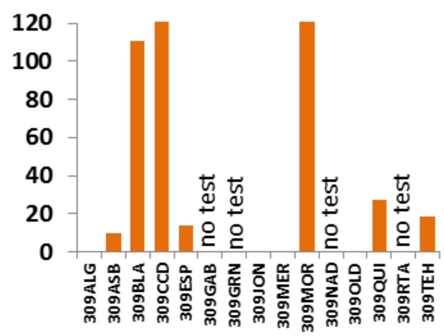
c) Fish toxicity in water - growth



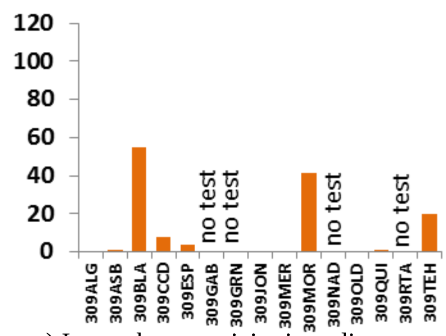
d) Invertebrate toxicity in water - survival



e) Invertebrate toxicity in water – growth



f) Invertebrate toxicity in sediment - survival



g) Invertebrate toxicity in sediment - growth

3.2.12 Other Parameters of Concern

Based on exceedances of Basin Plan objectives observed in CMP results, dissolved oxygen and pH may also be parameters of concern at several sites in the Salinas River region. The 7 mg/L dissolved oxygen concentration objective was met in all samples from the mainstem Salinas River in 2014, and in the Blanco Drain, Merrit Ditch, and south branch of Chualar Creek. In the Reclamation Canal upstream of Salinas, one sample fell below the 7 mg/L dissolved oxygen threshold. Six other sites fell short in multiple samples. Because Chualar Creek, Natividad Creek, and Quail Creek are not specifically listed in Table 2-1 of the Basin Plan, the Basin Plan assigns a dissolved oxygen objective for these water bodies of 5 mg/L with a median saturation percentage greater than 85%, based on beneficial uses of MUN, REC, and aquatic life[2]. Chualar Creek always met the 5 mg/L minimum dissolved oxygen limit in 2014, as did Quail Creek. Natividad Creek fell below 5 mg/L in one sample. Dissolved oxygen saturation was below 85% on a median basis at only four Salinas unit sites in 2014 – Moro Cojo Slough, Tembladero Slough, the Old Salinas River, and the Reclamation Canal downstream of Salinas.

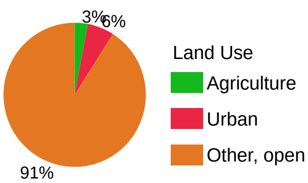
Seven sites in the Salinas hydrologic unit met the pH objectives in all samples from 2014, though three of these had no water to sample in any event. Two other sites (Blanco Drain and Tembladero Slough) had only one exceedance each, by just tenths of a pH unit. Nine other sites exceeded the objective by wider margins and/or on a more frequent basis, particularly the Reclamation Canal and Old Salinas River.

Trends in pH for 2006 to 2013 were predominantly decreasing and trends in dissolved oxygen were entirely increasing. More sites met pH objectives in all 2014 samples than had met them in 2013. Dissolved oxygen exceedance patterns seemed similar to 2013, and increasing trends in dissolved oxygen are difficult to interpret due to swings in both directions that can result from biostimulation. An increase does not always indicate improvement.

[2] For water bodies without beneficial uses designated in Table 2-1 of the Basin Plan, the Basin Plan specifies they are assigned the water quality objectives associated with Municipal and Domestic Water Supply, and protection of both recreation and aquatic life uses. These include specific numeric objectives for pH, unionized ammonia, and the following for dissolved oxygen, "For waters not mentioned by a specific beneficial use, dissolved oxygen concentration shall not be reduced below 5.0 mg/l at any time. Median values should not fall below 85 percent saturation as a result of controllable water quality conditions." (Page III-4, *Water Quality Control Plan For The Central Coast*).

3.3 ESTERO BAY (HU 310)

Descriptions of the Estero Bay Hydrologic Unit hydrology are summarized from the Central Coast Water Board's *Estero Hydrologic Unit Draft Assessment Report* (CCRWQCB 2006). The coastal watersheds of the Estero Bay Hydrologic Unit (HU 310) are in western San Luis Obispo County. Sixteen of the larger watersheds in the Hydrologic Unit were sampled by CCAMP during the 2002 sampling year.



Several urban areas including San Simeon, Cambria, Cayucos, Morro Bay, Los Osos, San Luis Obispo, Pismo Beach, Arroyo Grande, and Oceano are found in the area. Major land uses in the area include grazing, agriculture and residential. In the watersheds of San Simeon, Santa Rosa, Villa, Cayucos, Old, Toro and Morro Creeks the primary land uses are grazing, vineyards, avocado and orange orchards on multiple ranch properties. In recent years an increasing number of ranches are converting to vineyards and avocado orchards. Some areas include intensive agricultural cropping activities, particularly in the lower watersheds of Chorro Creek, Los Osos Creek, San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek.

Monitoring for the CMP was initiated in the Estero Bay hydrologic unit in January, 2006. There were originally six core CMP sites in the Estero Bay hydrologic unit. These sites are located on Chorro Creek (310CCC) and Warden Creek (310WRP) in the north of the watershed, Prefumo Creek (310PRE) and Davenport Creek (310SLD) near San Luis Obispo, and Arroyo Grande Creek (310USG), and Los Berros Creek (310LBC) upstream from Pismo Beach at the southern end of the watershed. The site on Davenport Creek was sampled only once due to lack of flow at the site or apparent connections to other water bodies upstream or downstream, and so was removed from the active monitoring schedule beginning January, 2012.

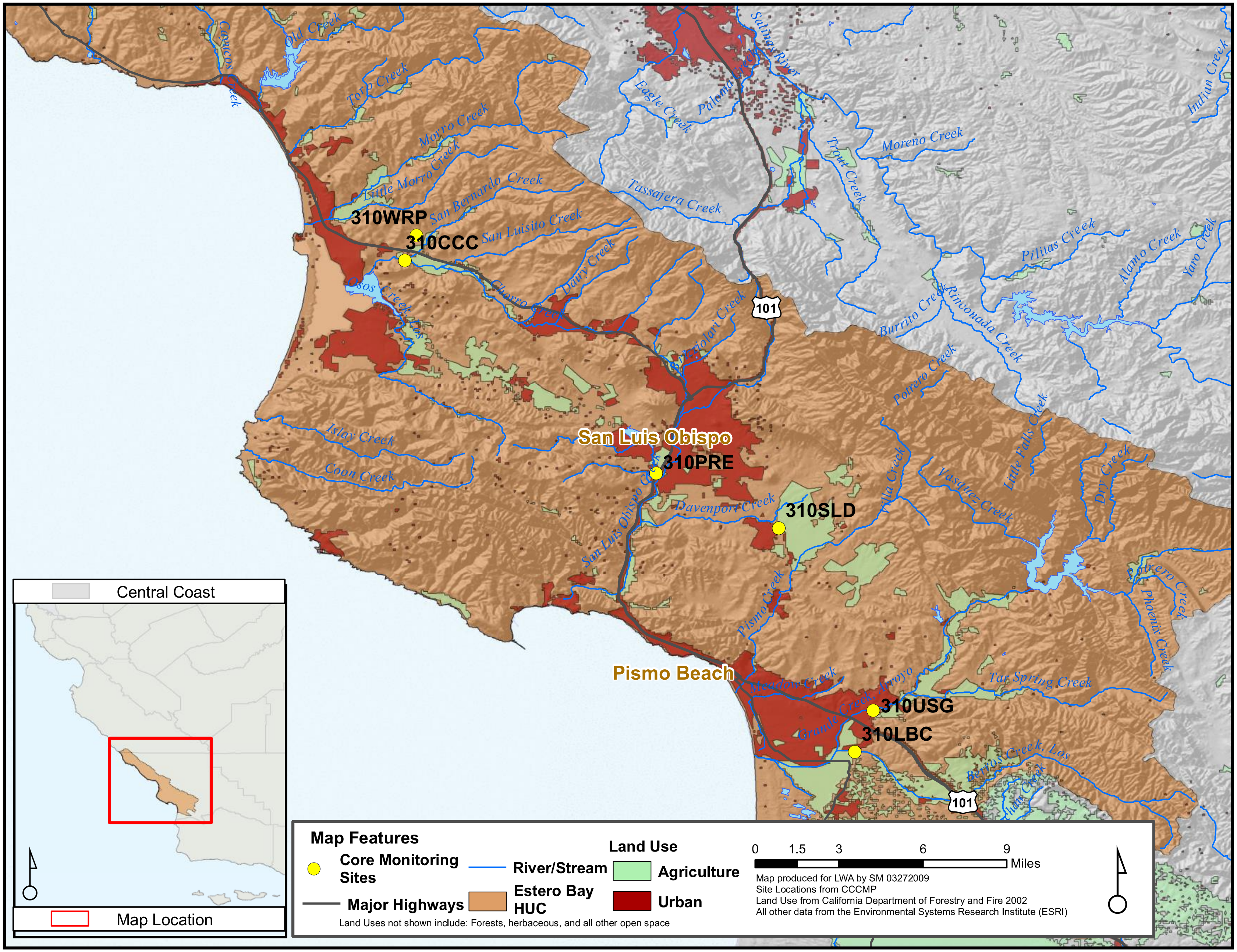


Figure 3-7. CMP core monitoring sites and distribution of major land uses in the Estero Bay Hydrologic Unit

3.3.1 Flow Results

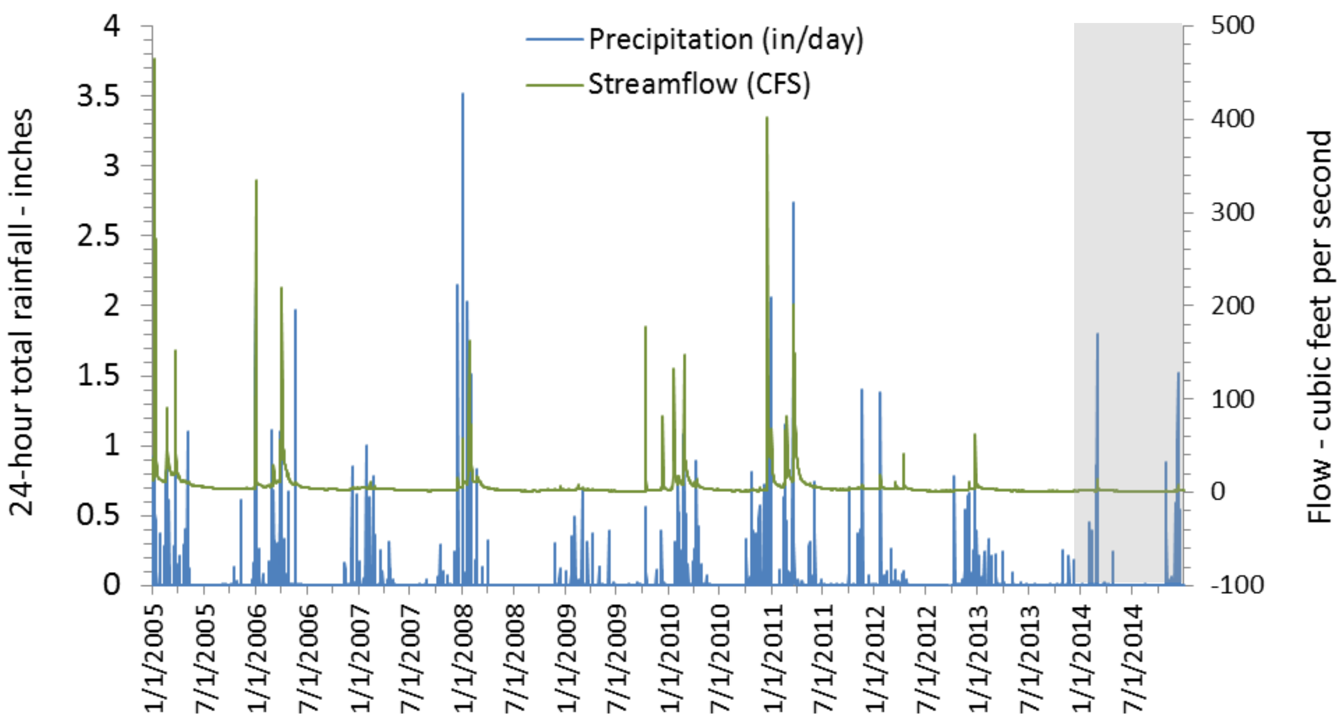
Seasonal patterns for the Estero Bay region are typical for the Central Coast region and are characterized by precipitation and flows that occur primarily from January through April, with the highest historical monthly average flows reported in February (46 CFS) and March (61 CFS) (USGS 2009). Because watersheds are relatively small in this region, flows increase quickly in response to precipitation events and decrease quickly in the dry season. In Arroyo Grande Creek, flows typically decrease rapidly in May and maintain low baseline flows less than 5 cfs from June through December (USGS 2009). High flows at the Arroyo Grande Creek USGS gauge have not been observed since early 2011 (Figure 3-8). Despite precipitation in 2014 at roughly five times the 2013 accumulation, flows in Arroyo Grande Creek remained very low throughout 2014, rarely reaching even 5 CFS. Flows in 2014 measured by the CMP were generally 1.2 to 3.7 CFS throughout the year, with the lowest Flow in May (0.3 CFS).

Flows measured at other Estero Bay region sample locations were also very low in 2014. High flows for the year were recorded in February. Los Berros Creek was dry and could not be sampled in any month of the year. Warden Creek was dry from June through December, and Chorro Creek was dry from June through November. Prefumo Creek and Arroyo Grande had at least small measurable flows during all twelve of the 2014 monitoring events.

Trends in flow measured between 2006 and 2013 were entirely decreasing. The 2014 results suggest a continuing pattern of low and reduced streamflow in the Estero Bay region.

Figure 3-8. Regional precipitation and flow patterns in the Estero Bay region

Precipitation data acquired from the California Irrigation Management Information System (CIMIS) at http://www.cimis.water.ca.gov/cimis. Historical average flows at Arroyo Grande acquired from USGS National Water Information System (http://nwis.waterdata.usgs.gov).



3.3.2 Turbidity Results

There is currently no numeric water quality objective for turbidity in the Central Coast Basin Plan. Average turbidities were below 12 NTU at all sites in 2014. Relative to each other however, Estero Bay region monitoring sites exhibited some minor differences in turbidity. Average and maximum turbidities were highest (11.6 NTU and 61 NTU, respectively) at Chorro Creek, and were lowest (2 NTU and 3.5 NTU, respectively) and least variable in Arroyo Grande Creek. The highest turbidities observed occurred during elevated flows in the February event, except in Arroyo Grande creek where the highest (albeit still low) measured turbidity level occurred in July.

There were almost no trends in turbidity in the Estero Bay hydrologic unit for the 2006-2013 period, which is fairly low to begin with, and 2014 results indicate that conditions have not changed.

3.3.3 Nutrient Results

Ammonia was not detected in the Estero Bay hydrologic unit in 2014, except for one sample each in January at Arroyo Grande, Warden, and Prefumo Creeks. The Prefumo Creek sample was below the reporting limit of 0.1 mg/L, and the Arroyo Grande and Warden Creek results were 0.25 and 0.38 mg/L, respectively. The total ammonia objective to protect agricultural uses applies to all five of the Estero Bay sites. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems.

The pattern of average unionized ammonia concentrations followed that of total ammonia. Unionized ammonia (a calculated parameter based on total ammonia, pH, and water temperature) was reported as "not detected" in cases where total ammonia was not detected. Calculated concentrations in the three instances where total ammonia was detected were less than 0.01 mg/L. No exceedances of the Basin Plan objective of 0.025 mg/L were observed in the Estero Bay hydrologic unit in 2014.

Average nitrate concentrations were highest in Warden Creek (28 mg/L). Nitrate concentrations did not exceed 10 mg/L in any samples from the other sites in the hydrologic unit in 2014, however several samples from Prefumo Creek were close to 10 mg/L. Arroyo Grande and Chorro Creeks had the lowest nitrate concentrations, with average values below 2 mg/L in both cases.

The 10 mg/L Primary MCL for nitrate based on the MUN beneficial use applies to four of five sites (all except Warden Creek) and the objective was not exceeded in any samples from these sites. Warden Creek had higher nitrate concentrations than the other sites, with a maximum value of 60 mg/L. The nitrate objective to protect agricultural uses applies at all five sites. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems". Because the objective for nitrate to protect municipal and domestic supply is more specific, it was used to assess exceedances.

Total nitrogen was driven by the nitrate component, with concentrations mirroring nitrate concentrations at all sites. The Organic N component was calculated by subtracting Total Ammonia from Total Kjeldahl N (TKN) results. Organic N comprised most of the TKN in 2014, particularly since ammonia was so infrequently detected.

As in prior years, the highest average and maximum orthophosphate concentrations occurred in Chorro Creek samples (0.9 and 1.2 mg/L, respectively). Average concentrations at other sites were below 0.5 mg/L or lower. There is currently no applicable numeric water quality objective for orthophosphate. Total phosphorus concentrations were similar to orthophosphate concentrations.

There were no trends in ammonia for the 2006 through 2013 period in this hydrologic unit, and ammonia detections are typically low to begin with. Orthophosphate trends detected were generally increasing, and nitrate trends generally decreasing. The 2014 results generally continued these patterns, with only three ammonia detections and no exceedances in 2014. Nitrate concentrations were similar to lower in 2014 than in 2013, and orthophosphate concentrations were comparable to slightly higher.

3.3.4 Conductivity, Dissolved Solids, and Salinity

Average conductivity was greater than 750 µS/cm at all five sites. The highest average and maximum conductivities were observed in Warden Creek (average 1898 and maximum 2048 µS/cm). Average conductivity was 1093 µS/cm in Arroyo Grande and 968 µS/cm and 974 µS/cm in Prefumo and Chorro Creeks, respectively. Conductivities were lowest for the year during the February monitoring event at all sites except Arroyo Grande, which showed the lowest conductivity in October. The variable conductivity objective to protect agricultural uses applies to all five sites. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems."

The relative spatial distribution of TDS and salinity concentrations was identical to the patterns for conductivity. Two sites in the Estero Bay unit have applicable TDS objectives: Chorro Creek (500 mg/L) and Arroyo Grande Creek (800 mg/L). This objective is applied as an annual average, and Chorro Creek exceeded the 500 mg/L threshold in 2014. Arroyo Grande Creek was below its 800 mg/L annual objective on average in 2014, both on an average basis and in each individual month except for May. There are currently no applicable numeric objectives for salinity in the Central Coast Region Basin Plan.

Trends in salinity-related parameters for the 2006 to 2013 period were entirely in the downward direction. The 2014 results for Arroyo Grande and Chorro Creeks were similar to 2013, and Warden Creek again had the highest average of all the Estero Bay sites. The Warden Creek average conductivity was a bit higher than in 2013, which may indicate that the declining trend is weakening.

3.3.5 Aquatic Toxicity

For samples collected in the Estero Bay region, proportions of toxic samples are illustrated in Figure 3-9. Toxicity to algae (low growth in sample water relative to a non-toxic control) occurred infrequently in prior years and so is being monitored on a reduced schedule for several Estero Bay HU sites for the 2012-2016 monitoring period. Toxicity to algae was not observed in the samples from Warden Creek (310WRP) collected in 2014. Toxicity to fish species was not observed at any of the Estero Bay sites either in 2014 (sampled at all 310 HU sites). Toxicity to invertebrates in water was limited to a significant reduction in reproduction in one sample (Arroyo Grande in August; reproduction 65% of control).

Toxicity to invertebrate species in sediment was observed only in Chorro Creek in 2014, and involved the survival endpoint (survival 77% of control). The other sites sampled did not have any reductions in growth or survival rates in 2014, though the April sample from Warden Creek was not interpretable due to the presence of resident *Hyalella* found in the sample sediment.

Toxicity data from 2013 indicated that toxicity to all species was declining in the Estero Bay hydrologic unit. The 2014 results continued those patterns, even for sediment, though the Warden Creek sample was thwarted for the second year in a row by resident *Hyalella*.

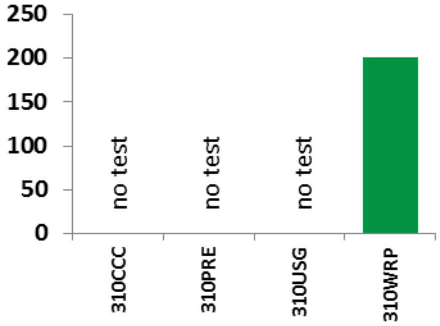
3.3.6 Other Parameters of Concern

Based on exceedances of Basin Plan objectives observed in CMP results, dissolved oxygen may be a parameter of concern at some sites in the Estero Bay region. Exceedances of (or failure to meet) the minimum objective for protection of cold water or spawning aquatic life (7 mg/L; warm water aquatic life objective of 5 mg/L applies only to Warden Creek) indicate that this parameter continues to be of concern in Prefumo Creek and Warden Creek, where none of the 2014 samples met dissolved oxygen objectives of 7 or 5 mg/L, respectively. Arroyo Grande met the 7 mg/L objective in all but one sample, and Chorro Creek met the objective in all 2014 samples. For the oxygen saturation objective of 85% on an annual average basis, only Arroyo Grande Creek met the objective (92% average). Chorro Creek fell just short (83%), and Prefumo and Warden Creeks were well below the objective (58% and 40%, respectively). All of the Estero Bay HU sites met their pH objectives (7-8.3 standard pH units) in all 2014 samples.

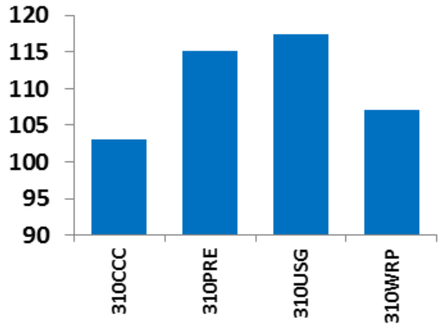
Trend analyses for 2006 through 2013 did not show trends in dissolved oxygen, and showed an increasing trend in pH at Warden Creek. The 2014 samples upheld the relatively stable history of dissolved oxygen levels. The 2014 results did not reinforce an increasing trend in pH, as all sites met their objectives, which if anything indicates a reduction in pH levels compared to the early years of the program.

Figure 3-9. Results for aq4uatic toxicity (water and sediment) monitoring in Estero Bay region

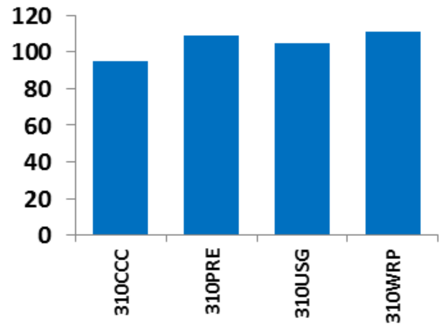
Bars represent the average survival, reproduction, or growth rate for all 2014 samples at each site, as compared to laboratory controls. There are 4 water toxicity sampling events (including algae, fish, and invertebrates), and 1 sediment toxicity sampling event at each site, each year.



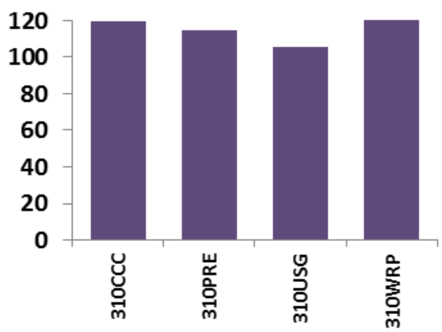
a) Algae toxicity in water - growth



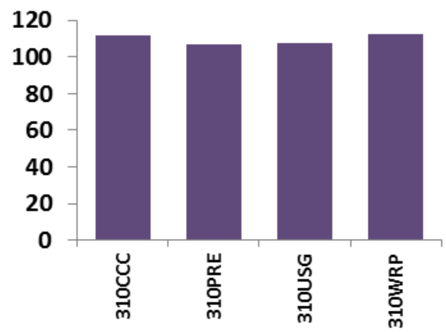
b) Fish toxicity in water - growth



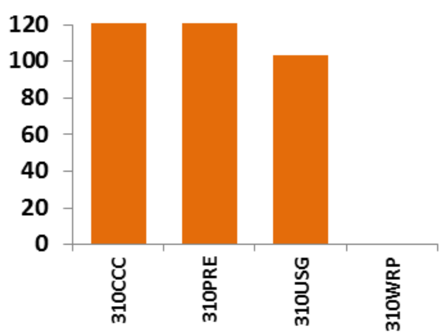
c) Fish toxicity in water – survival



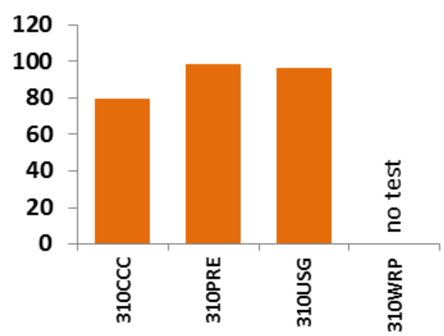
d) Invertebrate toxicity in water - reproduction



e) Invertebrate toxicity in water – survival



f) Invertebrate toxicity in sediment - growth

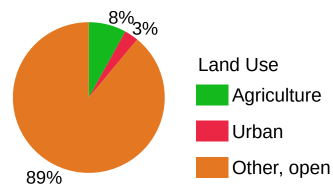


g) Invertebrate toxicity in sediment – survival

SANTA MARIA HYDROLOGIC UNIT (HU 312)

Descriptions of the Santa Maria Hydrologic Unit are summarized from the CCRWQCB's *Santa Maria River Hydrologic Unit Assessment Report* (CCRWQCB 2007). The Santa Maria River Hydrologic Unit (HU 312) includes all areas tributary to the Cuyama River, Sisquoc River, and Santa Maria River. At 1,880 square miles (1.2 million acres), the Santa Maria River watershed is one of the larger coastal drainage basins of California. The Cuyama River and Sisquoc River originate in wilderness areas of the Los Padres National Forest. The Santa Maria River is formed by the confluence of the Cuyama and Sisquoc approximately 7 miles southeast of Santa Maria. The Twitchell reservoir (completed in 1958) is located on the Cuyama River six miles above the confluence with the Sisquoc River. The Santa Maria valley is a broad flat valley, protected from flooding by levees and a series of flood control channels and basins. The river is the major source of recharge to the Santa Maria groundwater basin. Storm runoff and associated pollutants are also prone to infiltration, and even storms generally do not produce continuous flows along major segments of the Santa Maria River.

Nipomo Creek drains the Nipomo Valley and joins the Santa Maria River just west of US Highway 101. Orcutt-Solomon Creek drains the Orcutt area and joins the Santa Maria River near its outlet to the Pacific Ocean. Oso Flaco Lake and its drainage, though not part of the Santa Maria watershed, are included in Hydrologic Unit 312. Oso Flaco Lake is north of the Santa Maria Estuary. The outlet from Oso Flaco Lake flows directly to the ocean and is not tributary to the mainstem Santa Maria River.



Major land use activities in the Santa Maria watershed include irrigated and dryland agriculture, oil production, and urban development. Nearly 90% of the contributing watershed is undeveloped land, but the Santa Maria valley (where most monitoring sites are located) is predominantly agricultural and urban. Twitchell Reservoir in the north of the watershed serves important flood control and ground water recharge functions. Sedimentation of this reservoir is reducing its water storage capacity, and if allowed to continue will affect the reservoir's flood control capacity. There is little agricultural or urban development in the drainage contributing to Twitchell Reservoir.

Monitoring for the CMP was initiated in the Santa Maria area in January, 2005. There are ten core CMP sites in the Santa Maria hydrologic unit. The majority of these sites are located west of Santa Maria in Oso Flaco and Little Oso Flaco Creeks (312OFC and 312OFN), the mainstem Santa Maria River (312SMA and 312SMI), its major tributary Orcutt-Solomon Creek (312ORC and 312ORI) and sub-tributary Green Valley (312GVS). Three other sites are tributaries of the mainstem Santa Maria River: Bradley Channel (312BCJ) and Bradley Canyon Creek (312BCC) located east of Santa Maria and south of the river, and Main St. Canal (312MSD) located west of Santa Maria and south of the river.

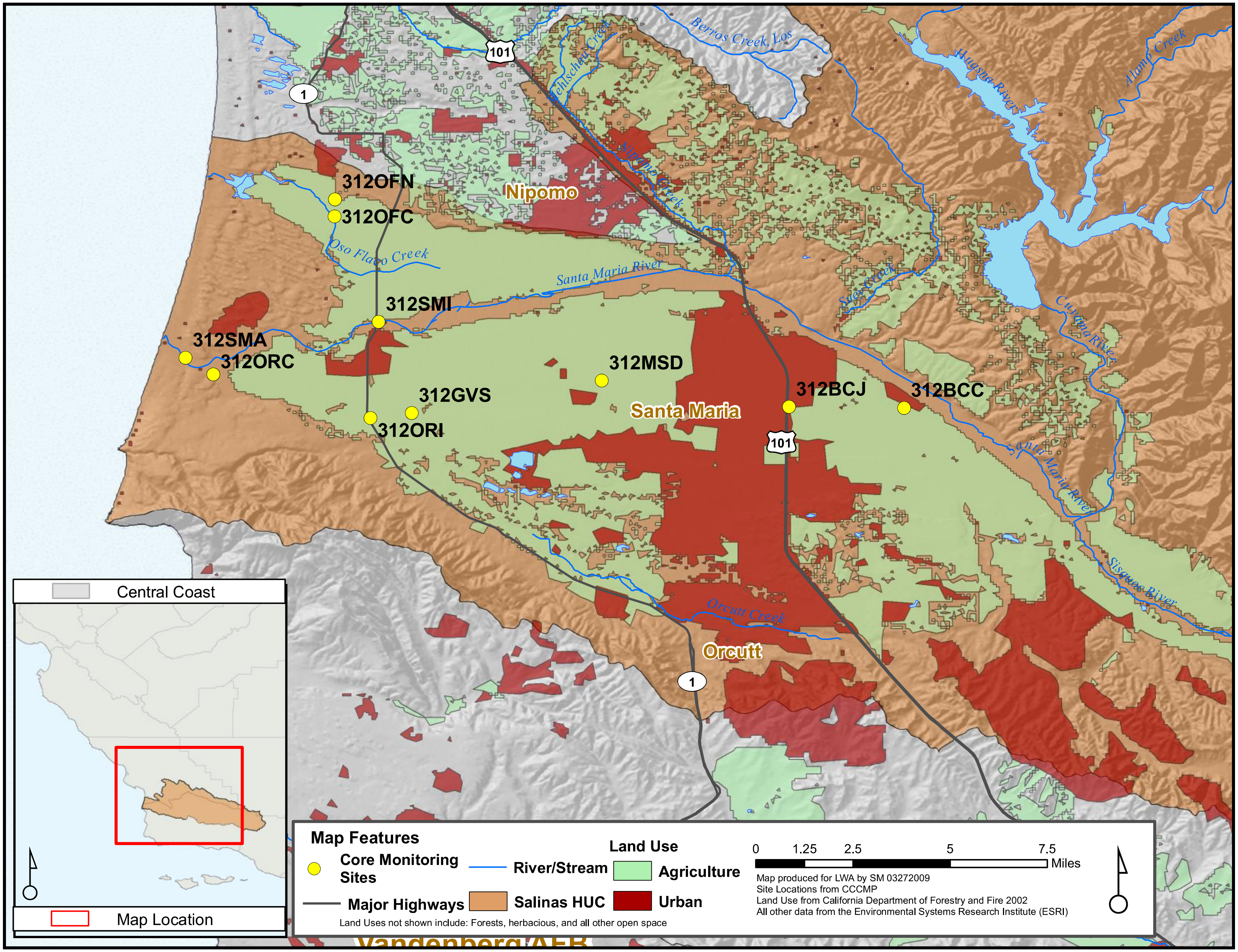


Figure 3-10. CMP core monitoring sites and distribution of major land uses in the Santa Maria River Hydrologic Unit

3.3.7 Flow Results

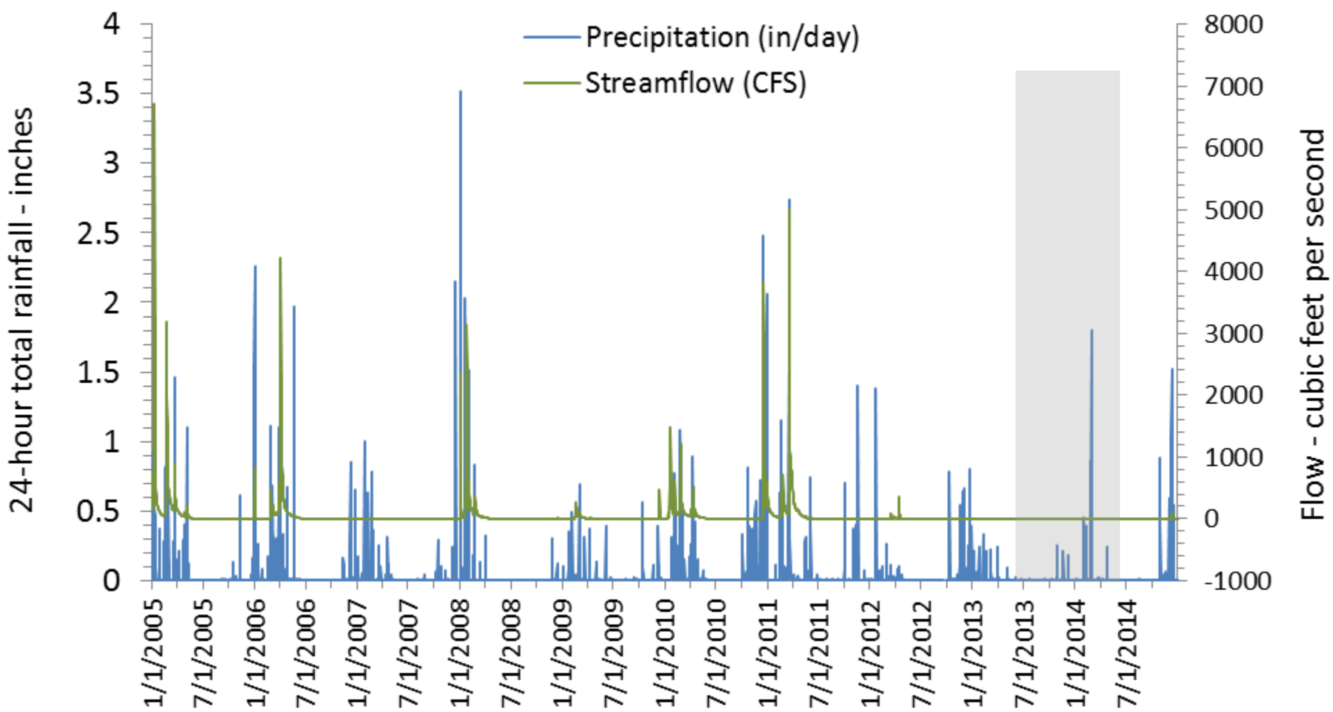
Seasonal patterns for the Santa Maria region are characterized by precipitation that occurs primarily from January through April in typical years, with the highest historical monthly average flows in the Santa Maria River near Guadalupe reported in March (137 CFS) (USGS 2009). Long term historical average flows in the river near Santa Maria at Highway 1 are below 1 CFS from June through December (USGS 2009), and in 2014 flows were absent for the entire monitoring period at this site. Flows were also absent further upstream near Suey Crossing and Sisquoc, except for a few days in early March (Figure 3-11). Precipitation in 2014 was substantially less than in the early years of the CMP, but had nearly twice the annual accumulation of 2012 or 2013.

In 2014 several of the sites had elevated flows in February or March as compared to other months. The Oso Flaco Creek, Santa Maria estuary, and lower Orcutt-Solomon Creek sites did not show as much seasonality in terms of elevated flows, but did have substantially reduced flows in the last few months of the year. Stream flows at Santa Maria sites in general were very low in 2014, with average flows below 1 CFS at all sites except the two Orcutt-Solomon sites and the Santa Maria estuary. That said, other than the mainstem river at Highway 1 and the Bradley Canyon Creek site, only Green Valley showed periodic dry or immeasurably low flow conditions. Most 2014 events at the Santa Maria sites were characterized by very low but consistent flows.

Almost all Santa Maria region sites showed declining trends in flow from 2005 through 2013. The 2014 monitoring results support this pattern.

Figure 3-11. Regional precipitation and flow patterns in the Santa Maria hydrologic region

Precipitation data acquired from the California Irrigation Management Information System (CIMIS) at http://www.cimis.water.ca.gov/cimis. Historical average flows at Sisquoc (through 2013) and Suey Crossing (2014) acquired from USGS National Water Information System (http://nwis.waterdata.usgs.gov).



3.3.8 Turbidity Results

There is currently no numeric water quality objective for turbidity in the Central Coast Basin Plan. In prior years average turbidities had been above 150 NTU at all sites, but in 2014 five sites had lower averages (Bradley Channel, Main Street Ditch, Oso Flaco, Little Oso Flaco, and Orcutt-Solomon at Highway 1). Relative to each other, Santa Maria region monitoring sites exhibited some differences in turbidity. The highest average and median turbidities (1000 NTU) were observed in Bradley Canyon Creek because the only measurement was taken during a storm event – the creek was dry the rest of the year. Orcutt-Solomon Creek by the sand plant also had a relatively high average turbidity (468 NTU), as did the Santa Maria River at the estuary (338 NTU). Green Valley had a high average turbidity level, but this was influenced by higher flow conditions because typical turbidities at that site were as low as 2 NTU. Orcutt-Solomon Creek at Highway 1 and Oso Flaco Creek had the lowest turbidity levels in 2014, at 36 and 41 NTU on average, respectively. The maximum turbidity levels at all sites were observed from January through May, with minimum levels occurring during the latter half of the calendar year.

Trends in turbidity detected in the Santa Maria region from 2005 through 2013 were limited to decreasing trends at the two Oso Flaco sites and in the Main Street Ditch. Those sites continued to show low to moderate turbidities in 2014, and sites that have been characteristically lower or higher in turbidity in the past seemed to produce similar results in 2014.

3.3.9 Nutrient Results

Total ammonia concentrations were often not detected at the Santa Maria sites in 2014, however there were a few very high detections. Interestingly, ammonia was not detected at any Santa Maria site during the July monitoring event and was detected at only one site each in September, October, and November. Average ammonia statistics tended to be skewed by single high measurements. Maximum ammonia concentrations were over 20 mg/L in Orcutt-Solomon Creek at Highway 1 and in the Bradley Canal, and over 5 mg/L in Oso Flaco Creek and Orcutt-Solomon at the sand plant. No site had consistent or repeated very high concentrations however, and Little Oso Flaco Creek had the lowest average concentration at 0.3 mg/L. The total ammonia objective to protect agricultural uses applies to Oso Flaco and Little Oso Flaco Creeks, Orcutt-Solomon Creek, and the mainstem Santa Maria River at Highway 1. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining "increasing problems" and "severe problems."

The spatial distribution of average unionized ammonia concentrations was generally similar to the pattern for total ammonia. Unionized ammonia levels were lowest in Little Oso Flaco Creek (312OFN, 0.001 mg/L). Exceedances of the Basin Plan objective of 0.025 mg/L were observed at six of the Santa Maria area sites in 2014 – Bradley Canal, Main Street Ditch, Orcutt-Solomon Creek at the sand plant and at Highway 1, Oso Flaco Creek, and Santa Maria River at the estuary. Little Oso Flaco Creek did not have unionized ammonia exceedances in 2014, and most sites with exceedances had only one for the year. The mainstem Santa Maria River was too dry to sample.

The 10 mg/L Basin Plan WQO for nitrate based on the municipal and domestic supply beneficial use applies to all Santa Maria region sites except the mainstem Santa Maria River at the estuary. The 10 mg/L objective was exceeded in all samples from these sites, with the only exceptions being about half of the samples from the Main Street Ditch and the one sample that was taken from Bradley Canyon Creek in February (the site was dry during all other 2014 events). Nitrate concentrations were consistently elevated at all sites, with average concentrations from 11.5 mg/L in the Main Street Ditch to 64 mg/L in Orcutt-Solomon Creek at Highway 1. The range of nitrate concentrations observed in 2014 was about 4 mg/L (Bradley Canyon Creek in February) to 80-90 mg/L (Bradley Canal in May, Green Valley in January, and Orcutt-Solomon at Hwy 1 during multiple events). The nitrate objective to protect agricultural uses applies to Oso Flaco and Little Oso Flaco Creeks, Orcutt-Solomon Creek, and the mainstem Santa Maria River at Highway 1. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining “increasing problems” and “severe problems”. Because the objective for nitrate to protect municipal and domestic supply is more specific, it was used to assess exceedances.

Total nitrogen was driven by the nitrate component as typically 90% to 100% of the total. The Organic N component was calculated by subtracting Total Ammonia from Total Kjeldahl N (TKN) results. Organic N comprised varying proportions of the TKN, in some cases only 10% and in other cases well over 90%. Samples with non-detected ammonia frequently had non-detected TKN as well.

Orthophosphate concentrations were commonly 0.2 to 0.4 mg/L at the Santa Maria area sites in 2014. Notable exceptions were Oso Flaco Creek, which had an average concentration of 0.18 mg/L, and the Main Street Ditch which had elevated levels in seven events ranging from 2.6 to 52 mg/L. There is currently no applicable numeric water quality objective for orthophosphate. Patterns in total phosphorus were similar to those for orthophosphate, although total phosphorus concentrations were considerably higher than orthophosphate concentrations, suggesting the presence of organic phosphorus.

There were a few trends at least in nutrients for 2005 through 2013, but at a small number of sites and without clear direction as a group. Dry season nitrate did appear to be declining at four sites though, and 2014 monitoring result reinforced that pattern.

3.3.10 Conductivity, Dissolved Solids, and Salinity

Average and median conductivities were greater than 1000 µS/cm at all sites sampled, except in Bradley Canyon Creek in February (the creek was dry the rest of the year). The highest average conductivities in 2014 (around 3000 µS/cm) were observed in Orcutt Solomon Creek (both sites) and the Santa Maria River at the estuary. The Basin Plan conductivity objective to protect agricultural uses applies to Oso Flaco and Little Oso Flaco Creeks, Orcutt-Solomon Creek, and the mainstem Santa Maria River at Highway 1. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining “increasing problems” and “severe problems”.

The relative spatial distributions of TDS and salinity concentrations were identical to the patterns for conductivity. No sites sampled in the Santa Maria unit have applicable TDS objectives. There are currently no applicable numeric objectives for salinity in the Central Coast Region Basin Plan.

Trends in salinity-related parameters were entirely in the downward direction for the 2006 to 2013 period. The 2014 data do not necessarily suggest further reductions, but do generally show similar concentrations of these parameters to 2013.

3.3.11 Toxicity and Pesticide Results

For aquatic toxicity samples collected in the Santa Maria River region, the proportions of toxic samples are illustrated in Figure 3-12.

Toxicity to algae (low growth in sample water relative to a non-toxic control) occurred in just three samples from the Santa Maria hydrologic unit in 2014, all from the Main Street Ditch (February, April, and August samples). Most other samples exhibited algae growth rates much higher than in laboratory control samples.

Toxicity to fish species (*Pimephales promelas* or *Cyprinodon variegatus*) occurred at four sites in 2014, primarily with effects to growth rates as compared to the control. The Main Street Ditch had a 0% survival rate in the April event but did not show toxicity to fish during the other toxicity monitoring months. Orcutt-Solomon Creek at the sand plant showed reduced growth rates in April and December.

Orcutt-Solomon Creek at Highway 1 showed reduced growth rates in April, and the Santa Maria River at the estuary showed reduced growth in December.

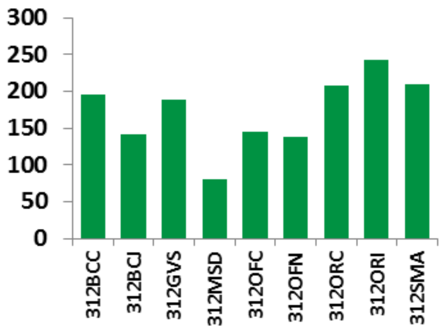
Toxicity to invertebrates in water (*Ceriodaphnia dubia* or *Hyalella azteca*) was observed in at least one sample from every site in the Santa Maria hydrologic unit in 2014. There was 0% survival in February samples from Bradley Canyon Creek, Green Valley, Oso Flaco and Little Oso Flaco Creeks, and in April samples from the Main Street Ditch, Orcutt-Solomon Creek at the sand plant, and the Santa Maria River at the estuary. Some sites had less frequent toxicity to invertebrates in 2014 (i.e. not all samples were toxic); these included the Bradley Canal at Jones St., the Main Street Ditch, Green Valley, Oso Flaco Creek and Little Oso Flaco Creek.

Toxicity to invertebrate species (*Hyalella azteca*) was very high in sediment samples from the Santa Maria region, with toxicity observed in every sediment sample tested (8 samples). All of the toxicity to invertebrates was of the mortality endpoint (0% to 73% survival rates). Two of the eight samples caused complete mortality to the test species (0% survival).

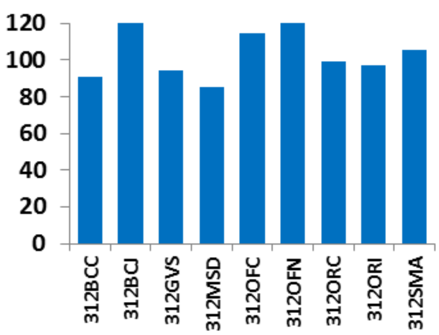
The 2014 monitoring results supported the 2012/2013 observation of reduced toxicity to algae. Toxicity to fish also appeared reduced in 2012 relative to prior years, however there didn't appear to be further improvement in 2013 and the same could be said for 2014 therefore the pattern may have ceased or be reversing itself. Toxicity to invertebrates in sediment continued in 2014, as it did in 2012/2013, relatively unchanged from early years of the program. Toxicity to invertebrates in water was reduced in 2012 and 2013 from prior years, but that trend may also have ceased or be reversing itself based on 2014 results.

Figure 3-12. Results for aquatic toxicity (water and sediment) monitoring in Santa Maria region

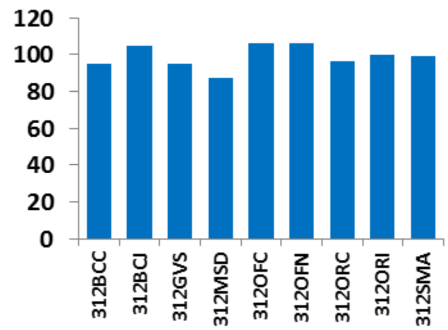
Bars represent the average survival, reproduction, or growth rate for all 2014 samples at each site, as compared to laboratory controls. Vertical black represent the range of results for the site. There are 4 water toxicity sampling events (including algae, fish, and invertebrates), and 1 sediment toxicity sampling event at each site, each year.



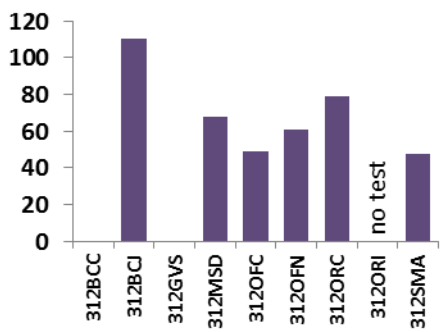
a) Algae toxicity in water - growth



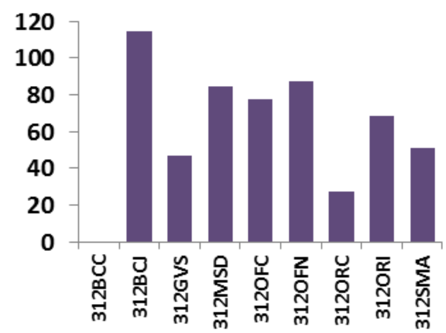
b) Fish toxicity in water – growth



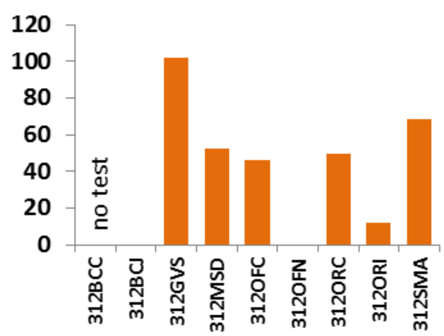
c) Fish toxicity in water - survival



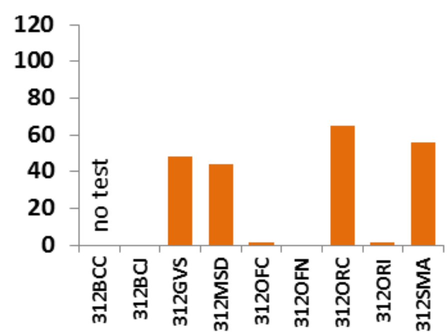
d) Invertebrate toxicity in water - reproduction



e) Invertebrate toxicity in water – survival



f) Invertebrate toxicity in sediment - growth



g) Invertebrate toxicity in sediment – survival

3.3.12 Other Parameters of Concern

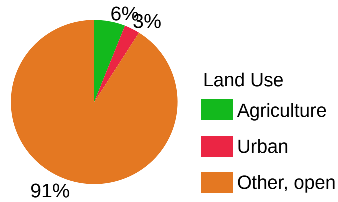
At the four sites where the minimum objective for protection of cold water or spawning aquatic life (7 mg/L) applies (both Orcutt-Solomon Creek sites and both mainstem Santa Maria River sites), these sites typically met the dissolved oxygen objectives, two samples in Orcutt-Solomon at the Sand Plant falling below. At the two Oso Flaco Creek sites, where the minimum WQO for protection of warm water aquatic life (5 mg/L) applies, four samples from Little Oso Flaco Creek did not meet the objective but all samples from Oso Flaco were above 5 mg/L. The four other regularly sampled sites (Bradley Channel, Bradley Canyon Creek, Green Valley, and Main Street Canal) had average dissolved oxygen concentrations and saturations that were comparable to the other sites, and met the dissolved oxygen concentration objectives in most samples. These four sites are not specifically listed in Table 2-1 of the Basin Plan , so the Basin Plan specifies that the dissolved oxygen objective for these water bodies is 5 mg/L, with median saturation percentage greater than 85%, based on the beneficial uses of MUN, REC, and aquatic life[3]. Only Little Oso Flaco Creek and Oso Flaco Creek did not meet the median 85% saturation objective for dissolved oxygen in 2014, though most other Santa Maria hydrologic unit sites had occasional samples with saturations below 85%.

All Santa Maria sites met the minimum pH WQO of 7 pH units in 2014, with the exception of one sample in the Main Street Ditch that measured 6.97 and one sample in Orcutt-Solomon Creek at Highway 1 which measured 6.86. The Bradley Channel at Jones Street and the Main Street Ditch did not meet upper pH WQO's in 2014, with results exceeding 8.5 pH units during several monitoring. Orcutt-Solomon Creek at Highway 1 had one sample with a result of 8.54 pH units.

The 2014 pH data were similar to results from 2012 and 2013. There were a few trends in pH for 2006-2013, so the 2014 data reinforce those. Changes to dissolved oxygen levels are difficult to interpret, and results for 2014 were similar enough to 2012/2013 that no major changes in dissolved oxygen are suggested.

[3] For water bodies without beneficial uses designated in Table 2-1 of the Basin Plan, the Basin Plan specifies they are assigned the water quality objectives associated with Municipal and Domestic Water Supply, and protection of both recreation and aquatic life uses. These include specific numeric objectives for pH, unionized ammonia, and the following for dissolved oxygen, "For waters not mentioned by a specific beneficial use, dissolved oxygen concentration shall not be reduced below 5.0 mg/l at any time. Median values should not fall below 85 percent saturation as a result of controllable water quality conditions." (Page III-4, *Water Quality Control Plan For The Central Coast*).

3.4 SANTA YNEZ HYDROLOGIC UNIT (HU 314)

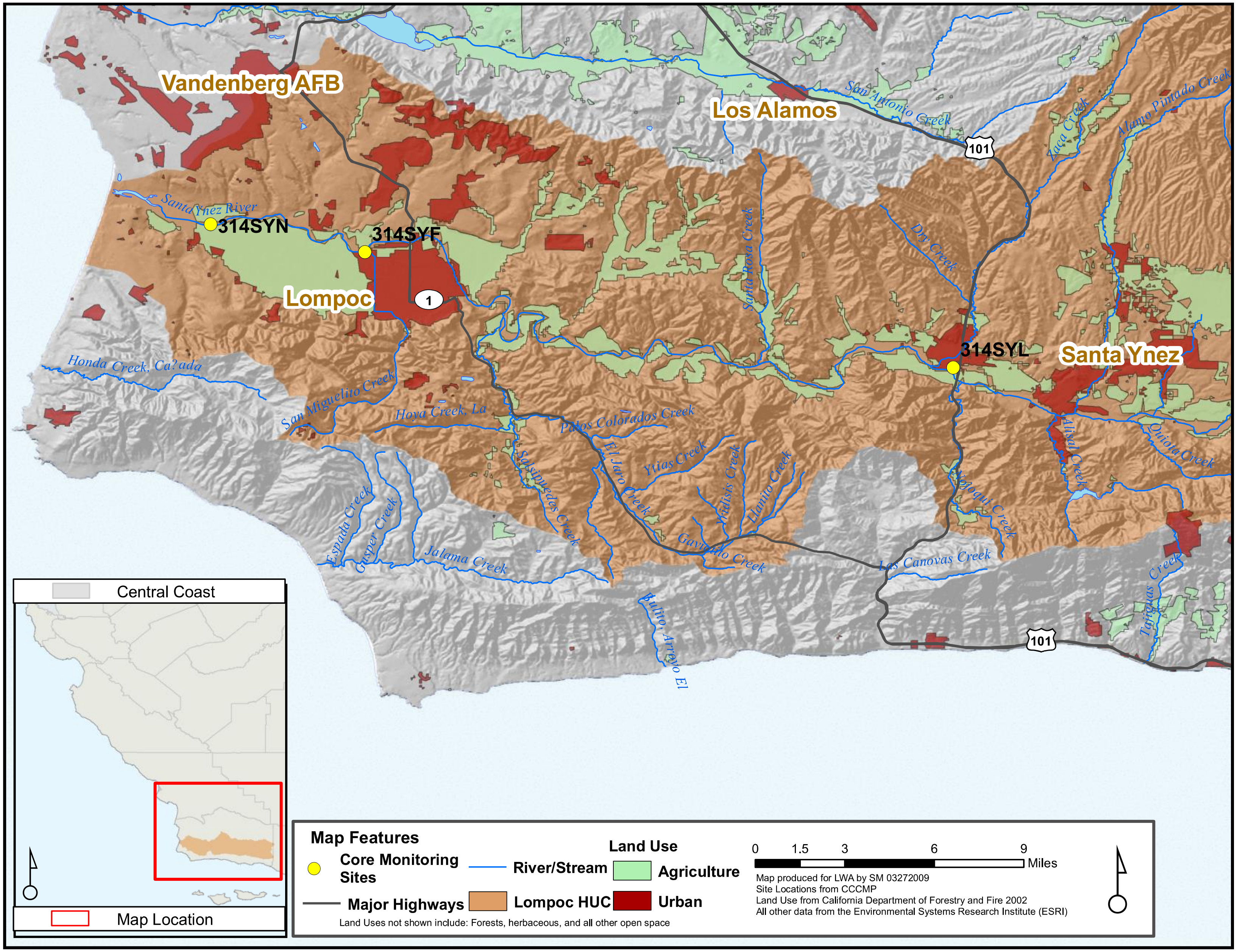


Descriptions of the Santa Ynez Hydrologic Unit are summarized from the State Water Resources Control Board's (SWRCB) Surface Water Ambient Monitoring Program (SWAMP) Assessment Report for the Central Coast Region (SWRCB 2007a). The Santa Ynez River watershed drains approximately 574,885 acres originating in the Santa Ynez Mountains of Los Padres National Forest, and is the only major watershed within the Santa Ynez River Hydrologic Unit. The Santa Ynez River watershed is the largest drainage system wholly located in Santa Barbara County, draining about 40 percent of the mainland part of the county. It is the primary source of water for about two-thirds of Santa Barbara County residents. Three reservoirs have been created along the river course. The Jamison and Gibraltar Reservoirs are located within Los Padres National Forest. Major tributaries to the river above these reservoirs include North Fork Juncal Creek, Agua Caliente Canyon Creek, Mono Creek and Indian Creek. Cachuma Reservoir is located along Highway 154, and major tributaries to the River between Gibraltar and Cachuma dam include Santa Cruz Creek and Cachuma Creek. The lower reaches of the River flow through Vandenberg Air Force Base property to the ocean at Surf Beach. Major tributaries below Cachuma Dam include Santa Aguenda Creek, Alamo Pintado Creek, Zaca Creek, Santa Rosa Creek and Salsipuedes Creek. Land uses that may impact water quality in the watershed include recreation (numerous campground and day use areas along the river in the National Forest and at Lake Cachuma), grazing, dry land agriculture, viticulture, and rural residential areas (including a large number of horse facilities). Urban and residential areas in the watershed include Solvang, Buelton and Lompoc. The City of Lompoc's wastewater treatment plant (WWTP) discharges to the river via San Miguelito Creek, and the Santa Ynez River below Lompoc is dominated by the treated waste water discharge during periods of low natural flow.

Monitoring for the CMP in the Santa Ynez hydrologic unit was initiated in January, 2006. There are three core CMP sites in the Santa Ynez hydrologic unit (Figure 3-13). All three sites are located on the Santa Ynez River. The most upstream site (314SYL) is located just upstream of Lompoc. This site has significant agricultural uses primarily concentrated along approximately 20 miles of river stretching upstream to the town of Santa Ynez. The middle site is located just downstream of Lompoc (314SYF) and the Lompoc WWTP discharge point. The most downstream site (314SYN) is located below an area dominated by approximately 9 square miles of intensive agricultural use, downstream and west of Lompoc (Figure 3-13).

The beneficial uses designated by the Basin Plan for the Santa Ynez River and the estuary include nearly every beneficial use, with the only exceptions being navigation, hydropower generation, aquaculture, and inland saline habitat (Table 2-2).

Figure 3-13. CMP core monitoring sites and distribution of major land uses in the Santa Ynez Hydrologic Unit



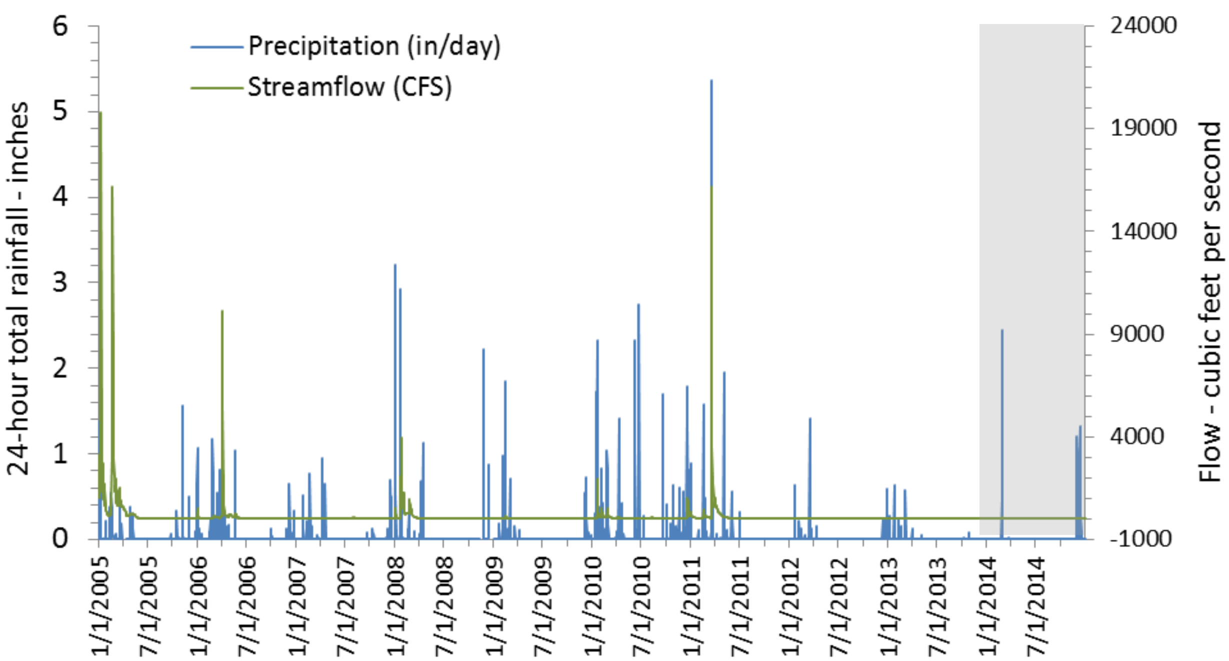
3.4.1 Flow Results

Seasonal patterns for the Santa Ynez River are characterized by precipitation that occurs primarily from January through April (Figure 3-14). Precipitation in 2014 was higher than in 2012 or 2013, but considerably less than in 2011 which was a wetter year. Flows typically decrease rapidly in May and the riverbed is often dry from June to November. In 2014 there was even less streamflow than usual, with no flow at the USGS gauge after May 1st and flows prior to that of only a few CFS except for the first half of March. The highest flows at Santa Ynez CMP sites in 2014 occurred during the February storm event, during which the river was not wadeable and the high flows could not be measured. The highest measurable flow was only 3 CFS, occurring in March at the Floradale Ave site. Besides the February high flow, the River Park site (above Lompoc) was dry during all other monitoring events. The Vandenburg site (downstream of Lompoc) had water from January through May. The Floradale Ave site was monitored on a reduced schedule due to limited agricultural inputs (water reflects mostly WWTP discharges), however water was present to sample during all visits to the site throughout the year. Any dry season flows in the upper Santa Ynez mainstem are contributed by outflows from Lake Cachuma, which were historically around 40 to 60 cfs.

All trends in flow detected in 2013 for the Santa Ynez hydrologic unit were in the downward direction. The 2014 monitoring results supported and strengthened this pattern.

Figure 3-14. Santa Ynez region flows and regional precipitation

Precipitation data for Santa Ynez acquired from the California Irrigation Management Information System (CIMIS) at http://www.cimis.water.ca.gov/cimis. Historical average flows for Santa Ynez River near Lompoc acquired from USGS National Water Information System (http://nwis.waterdata.usgs.gov).



3.4.2 Turbidity Results

There is currently no numeric water quality objective for turbidity in the Central Coast Basin Plan. Turbidity levels were low and comparable at the Floradale Ave and Vandenburg sites, generally 2-9 NTU. During the February storm event all there Santa Ynez River sites showed higher turbidity levels from 600 to 800 NTU. Trend analysis for 2006-2013 suggested a possible increase in turbidity at the Vandenburg site, however this is unlikely to be biologically meaningful as turbidity levels continued to be low to moderate at that site throughout 2014 except in a storm event.

3.4.3 Nutrient Results

Total ammonia was not detected in the majority of samples collected in the Santa Ynez hydrologic unit in 2014. Detections occurred only in January and February, on the order of 0.1 to 0.2 mg/L. The Basin Plan total ammonia objective to protect agricultural uses applies to all three Santa Ynez River sites, however a single numeric value from which to evaluate exceedance frequencies could not be determined. Unionized ammonia patterns mirrored those for total ammonia. No exceedances of the Basin Plan objective of 0.025 mg/L for unionized ammonia occurred in 2014.

The Basin Plan nitrate objective to protect agricultural uses applies to all three Santa Ynez River sites, however a single numeric value from which to evaluate exceedance frequencies could not be determined. The objective of 10 mg/L to protect municipal uses also applies to all three sites. Nitrate concentrations at the Vandenburg site were less than 1 mg/L except in March when the concentration was 20.4 mg/L. Nitrate at the Floradale site ranged from not detected during the February storm event to 8.5 mg/L in November of 2014. The upstream location at River Park had a low concentration – 0.6 mg/L – during the one monitoring event in which there was water to sample (February).

Total nitrogen concentrations and spatial patterns followed those for nitrate, except at the River Park site in February when the nitrate concentration was less than 1 mg/L but the total nitrogen was over 7 mg/L. The organic nitrogen component was calculated by subtracting Total Ammonia from Total Kjeldahl N (TKN) results. Organic nitrogen typically comprised two thirds or more of the TKN. Organic nitrogen appears to have been the cause of the elevated total nitrogen concentration at River Park in February.

The spatial distribution of orthophosphate concentrations was similar to that for nitrate, with the highest average orthophosphate concentrations at the Floradale site (3.8 mg/), and an average concentration of 0.5 mg/L at the 13th Street site. The upstream location at River Park had a relatively low orthophosphate concentration during the February storm event, at 0.08 mg/L. The maximum concentration at any Santa Ynez site in 2014 was 4.5 mg/L (at Floradale). There is currently no applicable numeric water quality objective for orthophosphate. Total phosphorus concentrations and spatial patterns followed those for orthophosphate, except at the River Park site in February when total phosphorus was measured at 8.5 mg/L, likely reflecting a large organic phosphorus contribution.

There were a few trends detected for nutrients for the 2006-2013 period, including an increasing trend for orthophosphate at the Floradale site and several declining trends for nitrate. From 2013 to 2014 there was little to no change in the various nutrient concentrations, except that the Vandenburg site had one uncharacteristically high nitrate measurement

3.4.4 Conductivity, Dissolved Solids, and Salinity

Average conductivity was 1000 to 1450 µS/cm at the Santa Ynez River sites in 2014. Conductivity was highest at the Floradale site, most commonly 1500-1600 µS/cm. The Basin Plan conductivity objective to protect agricultural uses applies to all three Santa Ynez River sites. This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining “increasing problems” and “severe problems.”

The relative spatial distributions of TDS and salinity concentrations were identical to the patterns for conductivity. All three sites in the Santa Ynez unit have applicable TDS objectives: Floradale and Vandenburg sites have a 1000 mg/L objective and the River Park location has a 700 mg/L objective for TDS. The objectives are applied as an annual average. Average TDS concentrations at all sites met these objectives in 2014. The average TDS concentration at the Floradale site was just below the objective (940 mg/L) in 2014. There are currently no applicable numeric objectives for salinity in the Central Coast Region Basin Plan.

Salinity-related monitoring results from 2014 were very similar to those of 2013. Relative to earlier years of the program, a downward trend in these parameters was detected at multiple Santa Ynez CMP sites in 2013.

3.4.5 Aquatic Toxicity Results

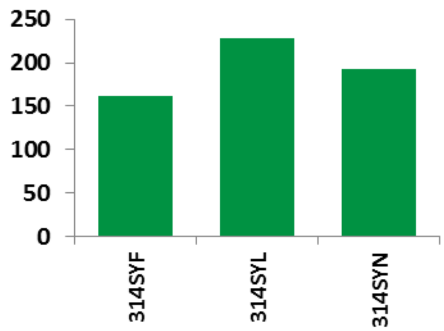
For aquatic toxicity samples collected in the Santa Ynez River region, proportions of toxic samples are illustrated in Figure 3-15. Most samples in 2014 exhibited algae growth rates much higher than in laboratory control samples, and there was no toxicity to algae (low growth in sample water relative to a non-toxic control) in the Santa Ynez hydrologic unit in 2014.

Toxicity to fish species (*Pimephales promelas*) was observed at each of the three sites in February of 2014, with significant effects to growth rates in sample water relative to the laboratory control. There was no toxicity to invertebrates in water observed in 2014, and toxicity in sediment was not assessed in 2014 due to lack of toxic history at these sites. Sediment samples collected in 2013 did not show toxicity, and will likely be collected again in 2017.

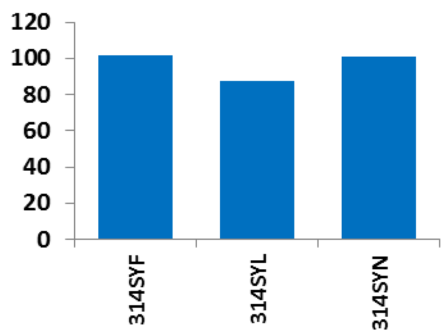
These results reinforce the historic lack of toxicity to algae in the Santa Ynez hydrologic unit, and the reduced toxicity to invertebrates in water that was noted in 2012/2013. The presence of toxicity to fish in 2014, however, is a departure from 2012/2013 when there was no toxicity to fish in this region.

Figure 3-15. Results for aquatic toxicity (water and sediment) monitoring in Santa Ynez region

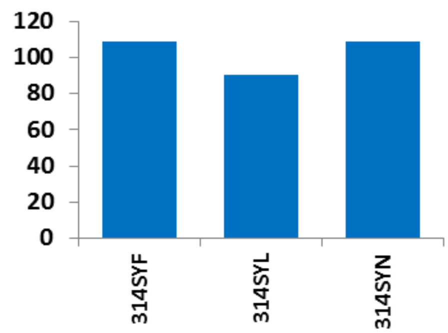
Bars represent the average survival, reproduction, or growth rate for all 2013 samples at each site, as compared to laboratory controls. Vertical black represent the range of results for the site. There are 4 water toxicity sampling events (including algae, fish, and invertebrates), and 1 sediment toxicity sampling event at each site, each year.



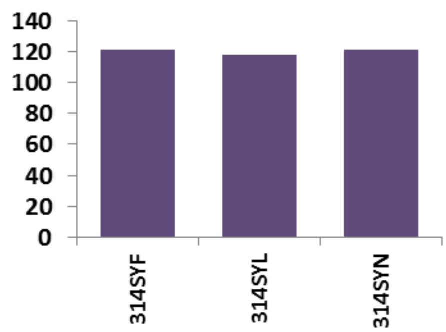
a) Algae toxicity in water - growth



b) Fish toxicity in water - growth



c) Fish toxicity in water - survival



d) Invertebrate toxicity in water - reproduction

e) Invertebrate toxicity in water – survival

Sediment samples not collected at any Santa Ynez hydrologic unit sites in 2014 due to lack of history of toxicity. Sediment samples in 2013 were all non-toxic; sampling is planned next for 2017.

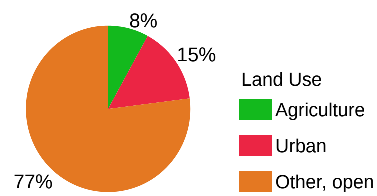
3.4.6 Other Parameters of Concern

Based on the frequency of exceedances of Basin Plan objectives, dissolved oxygen is also a parameter of concern in the lower Santa Ynez River. The frequency of exceedance was highest for dissolved oxygen at the Floradale location, which only met the 7 mg/L objective for cold water habitat during the February storm event and had an annual average saturation of 70%. The Vandenburg site fell below 7 mg/L on one occasion (May; 5.8 mg/L) but had an annual average dissolved oxygen saturation of 93%. Dissolved oxygen concentration exceedances did not occur at the River Park site in 2014, however the saturation level measured during the only event with water was 78% which does not meet the annual average threshold requirement of 85%. Exceedances of pH criteria were not observed in this hydrologic unit in 2014.

The Floradale site, and to some extent the River Park site, showed some increasing trends in pH and dissolved oxygen in 2013, though exceedances of pH criteria were not observed. Dissolved oxygen exceedance patterns in 2014 were similar to those for 2013.

3.5 SANTA BARBARA COASTAL CREEKS, SOUTH COAST UNIT (HU 315)

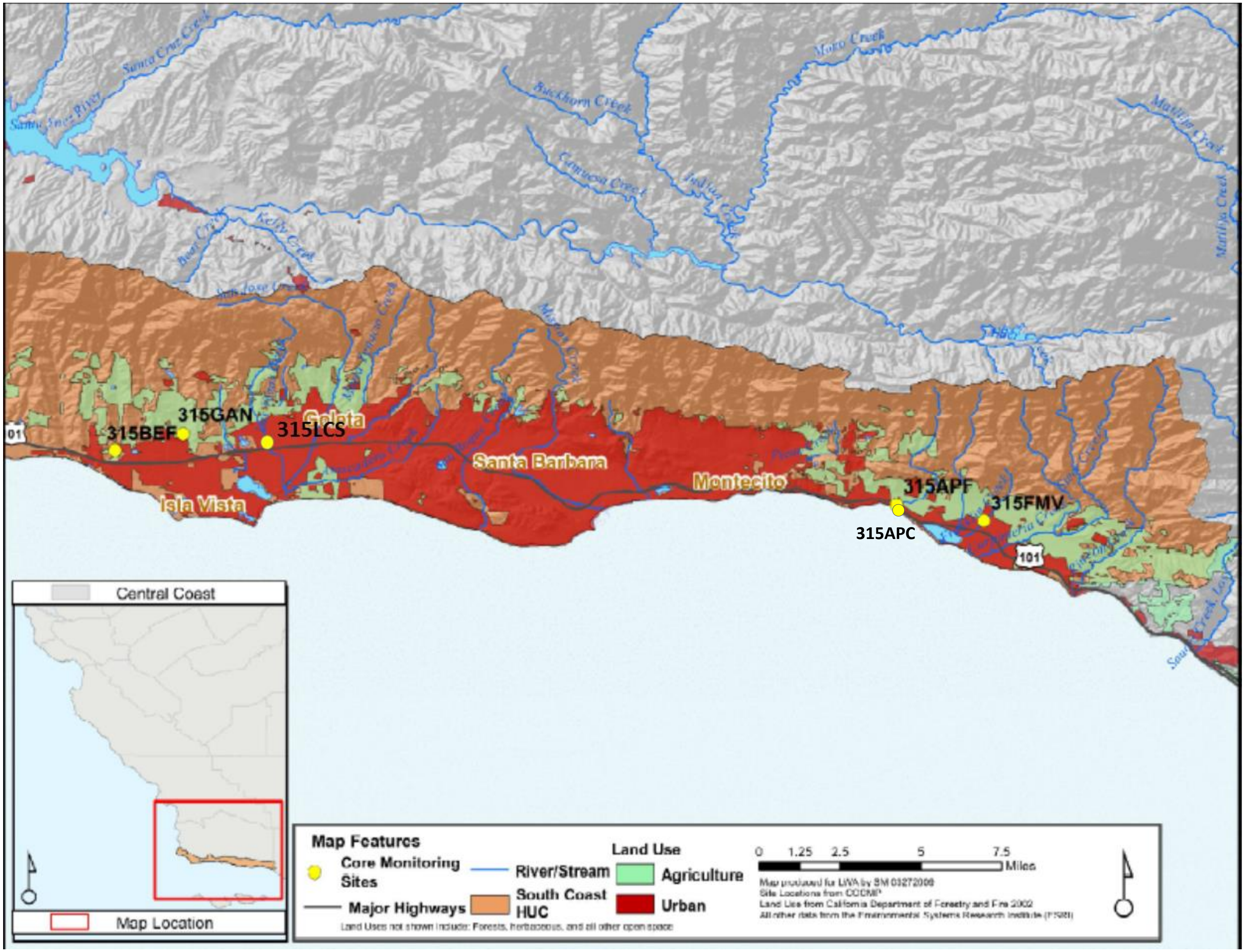
Descriptions of the South Coast Hydrologic Unit are summarized from the SWRCB's SWAMP Assessment Report for the Central Coast Region (SWRCB 2007b). The South Coast Hydrologic Unit is made up of small coastal watersheds originating in the southern Los Padres National Forest and draining to the Santa Barbara coast. All watersheds in this unit are completely within Santa Barbara County. The lowest reaches of several of these creeks flow through County and State Park campgrounds; these include Jalama County Park, Gaviota, Refugio, El Capitan and Carpinteria State Parks. Channelization is common in the Unit, as many of these creeks flow through urbanized flood plains. In the Carpinteria and Santa Barbara area, channelized watersheds include Arroyo Burro, Mission, Sycamore, San Ysidro, Romero, Toro, Arroyo Paredon, Santa Monica and Franklin Creeks. Franklin and Santa Monica Creeks are contained in cement box channels as they flow through intensive multi-use agriculture in the form of greenhouses and nurseries, as well as residential and light commercial development. Arroyo Paredon Creek is located just north of the city of Carpinteria and flows primarily through rural residential and greenhouse areas. The Goleta Slough watershed includes Los Carneros, Glen Annie, San Jose, San Pedro, Atascadero and Maria Ygnacio Creeks. Each of these creeks is channelized to some extent as they flow through the urban areas of Goleta. Los Carneros, Glen Annie, San Pedro and San Jose creeks have been converted to cement box channels in the lowest reaches and sediment is mechanically removed annually. Gaviota Creek has been completely channelized as it flows along Highway 101.



Most of these creeks originate in steep chaparral, southern coastal scrub and woodland habitat, flow through mid-elevations which often support estate homes and other rural residential uses, and then through flat coastal terraces to the ocean. In the northwestern part of the Unit coastal terraces are predominately used for grazing and agriculture. From Goleta southeast through the communities of Santa Barbara and Carpinteria, the terrace is largely urbanized. Several of the nurseries and greenhouses in these watersheds have direct discharge points to the creek channels.

Monitoring for the CMP was initiated in this hydrologic unit in January, 2006. There are four core sites monitored for the CMP in the Santa Barbara Coastal Creeks hydrologic unit. These are located in Bell Creek (315BEF), Glen Annie Creek (315GAN), Arroyo Paredon (315APF), and Franklin Creek (315FMV). Bell Creek and Glen Annie Creek are located west of Goleta, and Arroyo Paredon and Franklin Creek are located east of Santa Barbara, just west of Carpinteria. In 2014 the Arroyo Paredon water body was erroneously monitored at a different location (315APC, located at Via Real instead of the routine Foothill Rd. location; shown in Figure 3-16). The site was returned to Foothill Rd. in early 2015. Beginning in 2012 an additional site – Los Carneros Creek (315LCC) – was added to the program, to be addressed in part by CMP monitoring and in part by data sharing from existing monitoring conducted by the Santa Barbara Channelkeeper organization.

Figure 3-16. CMP core monitoring sites and distribution of major land uses in the South Coast Hydrologic Unit



3.5.1 Flow Results

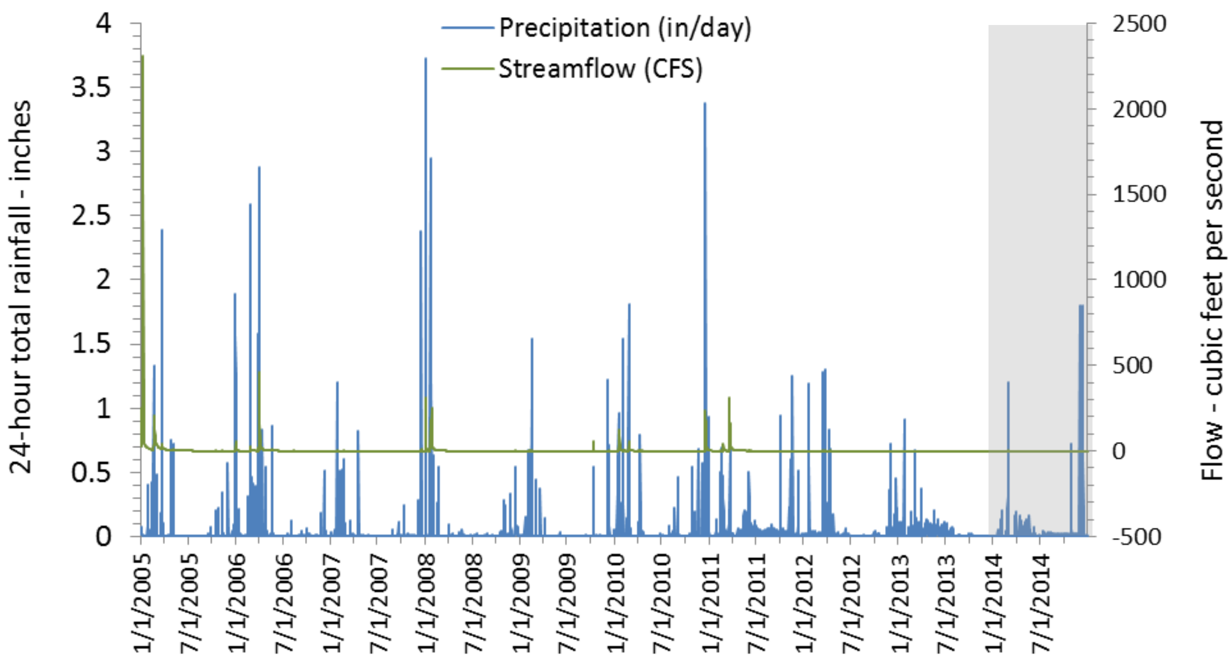
Seasonal patterns for the Santa Barbara region are characterized by precipitation that occurs primarily from January through April, with the highest historical monthly average flows reported in February (46 CFS) and March (61 CFS) (USGS 2009). Because watersheds are relatively small in this region, flows increase quickly in response to precipitation events and decrease quickly in the dry season. In Carpenteria Creek, flows typically decrease rapidly in May and average flows have historically been less than 5 cfs from May through December (USGS 2009). Flows in CMP water bodies are lower still, even at their peak. In 2014 the total annual precipitation returned to somewhat normal levels after having dropped in 2013 (Figure 3-17). Flow rates at the USGS gauge in Carpinteria Creek rebounded to 2012 levels, having nearly disappeared in 2013, but not to the higher flows of years prior.

During 2014 CMP monitoring, flows at all CMP sites in this hydrologic unit were almost all less than 0.5 CFS except during February and December rain events, with median values below 0.3 CFS. Average flows in Bell Creek, Franklin Creek, and Glen Annie were 0.2 to 0.3 CFS, with one dry event in each water body and maximum flows of 0.8 CFS (Franklin Creek) to 1.4 CFS (Bell Creek). Bell Creek was dry from July through November. Maximum 2014 flows occurred in February Franklin Creek (3.6 CFS) and in December in Arroyo Paredon, Bell Creek and Glen Annie (1.2, 3.4, and 23 CFS respectively). Glen Annie also increased flow in October (of about 1 CFS), which was not driven by precipitation.

Bell Creek and Glen Annie showed declining trends in stream flow from 2006 through 2013. The 2014 flow data were generally similar to prior years, and perhaps even a bit further reduced in Franklin Creek.

Figure 3-17. South Coast region flows and regional precipitation

Precipitation data for Montecito acquired from the California Irrigation Management Information System (CIMIS) at http://www.cimis.water.ca.gov/cimis. Historical average flows for Carpenteria Creek acquired from USGS National Water Information System (http://nwis.waterdata.usgs.gov).



3.5.2 Turbidity Results

There is currently no numeric water quality objective for turbidity in the Central Coast Basin Plan, however there some differences worth mentioning between some sites in the South Coast region relative to others. Turbidities in all South Coast CMP water bodies were most commonly under 5 NTU in 2014. Average turbidities (19-288 NTU) were skewed by high turbidity levels which occurred during rain events, however all sites had median turbidities below 5 NTU. Maximum turbidities were 1000 NTU in Bell Creek, about 430 to 775 NTU in Arroyo Paredon and Glen Annie, and 148 NTU in Franklin Creek.

There was a declining trend in turbidity for Franklin Creek for 2006-2013. Routine turbidity levels in Franklin were similar in 2014, but turbidities associated with higher flows were higher in 2014 than what was observed in 2013. Overall, turbidity was reduced in this hydrologic unit relative to early years of the CMP.

3.5.3 Nutrient Results

Total ammonia concentrations were relatively low and did not differ much among South Coast sites. Average concentrations in 2014 were between 0.06 mg/L and 0.16 mg/L for all four sites, with no samples above 0.45 mg/L and many non-detects. The highest concentrations in 2014 were in Arroyo Paredon and Bell Creek (0.45 and 0.41 mg/L, respectively). The Basin Plan ammonia objective to protect agricultural uses applies to three South Coast River sites, Arroyo Paredon, Franklin Creek, and Glenn Annie (315APF, 315FMV, 315GAN). This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining “increasing problems” and “severe problems”.

Unionized ammonia concentrations in 2014 were also somewhat reduced from previous years, with all detections well below 0.01 mg/L. There were no exceedances of the Basin Plan objective of 0.025 mg/L to protect aquatic life.

Average nitrate concentrations were highest in Franklin Creek (315FMV, 17 mg/L) and Arroyo Paredon (31 mg/L). Bell Creek had much lower nitrate concentrations (7 mg/L on average and 12 mg/L maximum), with Glen Annie at 12 mg/L on average in 2014. Maximum nitrate concentrations ranged from 12 mg/L in Bell Creek to 39 mg/L in Arroyo Paredon, and all sites showed reduced concentrations in February and December. The 10 mg/L objective for municipal and domestic supply and the variable objective for agricultural beneficial uses both apply specifically to three sites (315GAN, 315APF, 315FMV). The 10 mg/L WQO also applies to Bell Creek which is not specifically listed in Table 2-1 of the Basin Plan. The Basin Plan nitrate objective to protect agricultural uses applies to three South Coast River sites, Arroyo Paredon, Franklin Creek, and Glenn Annie (315APF, 315FMV, 315GAN). This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining “increasing problems” and “severe problems”. Because the objective for nitrate to protect municipal and domestic supply is more specific, it was used to assess exceedances. The 10 mg/L nitrate objective was exceeded in all samples from Arroyo Paredon, in 9 of 12 samples from Franklin Creek, in 10 of 12 samples from Glen Annie, and only in one sample from Bell Creek.

Total nitrogen concentrations followed patterns in nitrate. The Organic N component was calculated by subtracting total ammonia from Total Kjeldahl N (TKN) results. Organic nitrogen was frequently not detected in the South Coast watersheds in 2014, but for samples with detections organic nitrogen typically comprised 85% to 85% of the TKN.

The spatial distribution of orthophosphate concentrations was similar to that for nitrate, with the highest average orthophosphate concentrations in Arroyo Paredon (2.5 mg/L) and Franklin Creek (1.1 mg/L) in

2014. Maximum concentrations in both of those water bodies were over 6 mg/L. Conversely, maximum concentrations were under 0.5 mg/L in both Bell Creek and Glen Annie in 2014. There is currently no applicable numeric water quality objective in the Basin Plan for orthophosphate. Total phosphorus concentrations followed patterns in orthophosphate.

Nitrate levels were lower in 2012/2013 than in prior years, and the 2014 data continued to show that pattern. A trend at the Arroyo Paredon site could not be determined due to a temporary shift in sampling site location which clearly incorporated new inputs, making data from the two locations non-comparable. There was a very strong pattern of increased orthophosphate concentrations in the South Coast hydrologic unit in 2013 as compared to early years of the program. The 2014 data upheld 2013 levels but did not suggest further increases.

3.5.4 Conductivity, Dissolved Solids, and Salinity

Average conductivity was much greater than 750 µS/cm at all sites sampled. The highest maximum conductivity in 2014 was in Bell Creek (5286 µS/cm), and Bell Creek also had the highest average conductivity at 3277 µS/cm. Arroyo Paredon and Glen Annie were similar to each other with averages in the range of 2000-2200 µS/cm. Franklin Creek had lower conductivities at 1233 µS/cm on average and a maximum observation of 1999 µS/cm.The Basin Plan nitrate objective to protect agricultural uses applies to three South Coast unit sites, Arroyo Paredon, Franklin Creek, and Glenn Annie (315APF, 315FMV, 315GAN). This agricultural objective does not define a single numeric value from which to evaluate exceedance frequencies, but does provide ranges defining “increasing problems” and “severe problems”. Bell Creek is not specifically listed in Table 2-1 of the Basin Plan, but all samples for this site also had conductivity greater than 750 µS/cm.

The relative spatial distributions of TDS and salinity concentrations were similar to the patterns for conductivity. Franklin Creek had the lowest TDS concentrations and salinity, both in terms of average and maximum levels. Bell Creek had the highest. No sites sampled in the South Coast unit have applicable TDS objectives in the Basin Plan. There is currently no applicable numeric water quality objective for salinity in the Basin Plan.

Trends in salinity related parameters showed reductions from 2006-2013 in Franklin Creek and to some extent Glen Annie. The 2014 data showed comparable levels to 2013, and perhaps further reductions at the Franklin Creek site.

3.5.5 Toxicity Results

Toxicity to algae (low growth in sample water relative to a non-toxic control) was not tested in Franklin Creek or Arroyo Paredon in 2014. Though Bell Creek did not show any toxicity to algae in 2014, Glen Annie had reduced growth rates (42-55% of control) in the April and August samples.

Toxicity to fish species (*Pimephales promelas* or *Cyprinodon variegatus*) was assessed at all four sites but not observed in any samples from the South Coast hydrologic unit in 2014. This is consistent with prior years’ data, in which toxicity to fish was rare or absent.

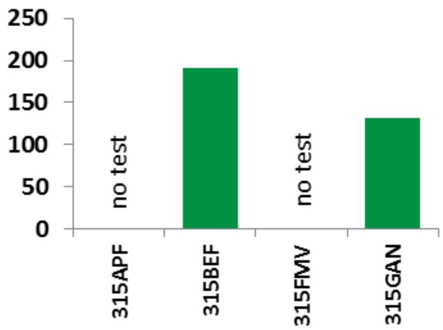
Toxicity to invertebrate species in water (*Ceriodaphnia dubia or Hyalella azteca*) was observed in samples from Arroyo Paredon during all four toxicity monitoring events in 2014. Franklin Creek samples showed toxicity to invertebrates in February, August and December. Bell Creek showed toxicity only to reproductive rates, in the December sample. No toxicity to invertebrates was observed in Glen Annie in 2014.

Toxicity to invertebrate species in sediment (*Hyalella azteca* or *Eohaustorius estuaris*) was observed in Arroyo Paredon in 2014, and the other sites were not sampled for sediment toxicity due to being on a reduced schedule for lack of history of toxicity. Franklin Creek could not be sampled for sediment toxicity due to lack of sediment.

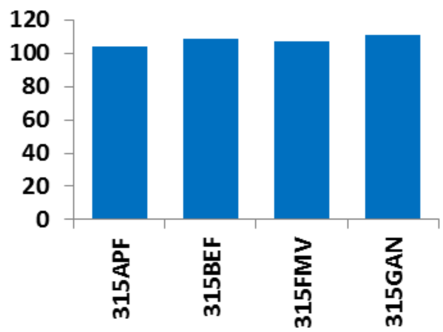
Toxicity to algae and fish in 2014 was consistent with 2012/2013 results, which were generally in line with results from prior years. Toxicity to invertebrates in water and possibly to invertebrates in sediment, however, was higher in 2014 than in 2012 or 2013 which may indicate that the previously improving trend has reversed itself.

Figure 3-18 Results for aquatic toxicity (water and sediment) monitoring in the South Coast region

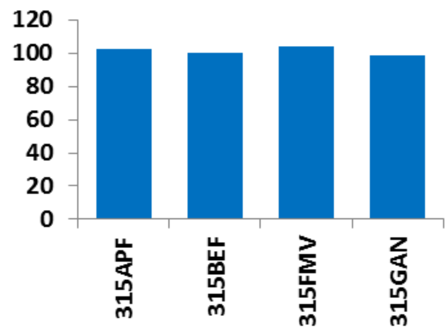
Bars represent the average survival, reproduction, or growth rate for all 2014 samples at each site, as compared to laboratory controls. There are 4 water toxicity sampling events (including algae, fish, and invertebrates), and 1 sediment toxicity sampling event at each site, each year.



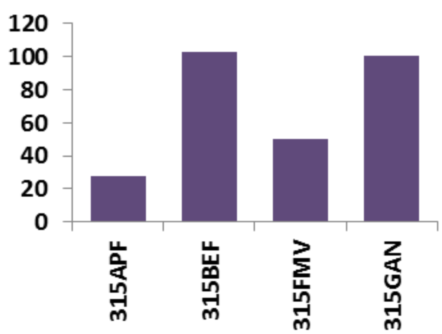
a) Algae toxicity in water - growth



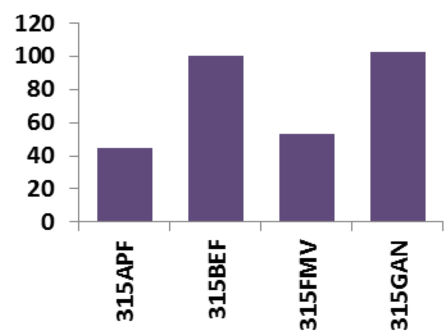
b) Fish toxicity in water - growth



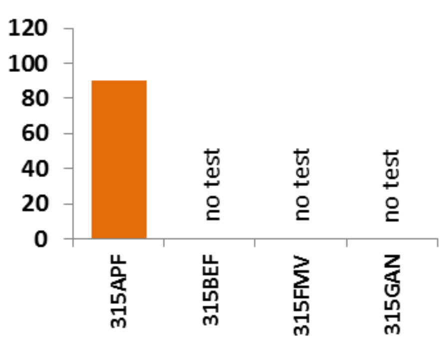
c) Fish toxicity in water - survival



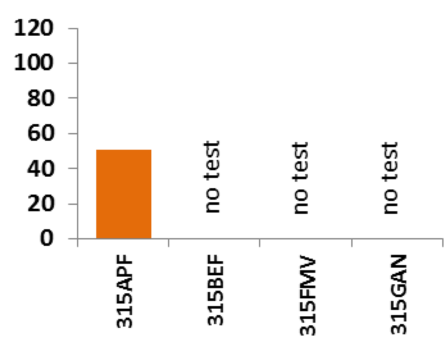
d) Invertebrate toxicity in water - reproduction



e) Invertebrate toxicity in water – survival



f) Invertebrate toxicity in sediment - growth



g) Invertebrate toxicity in sediment – survival

3.5.6 Other Parameters of Concern

Exceedances of Basin Plan objectives observed in CMP results for dissolved oxygen and pH did occur in 2014, but were somewhat isolated in terms of location or frequency of occurrence. At the three sites where the minimum objective for protection of cold water or spawning aquatic life (7 mg/L) applies, Franklin Creek met the dissolved oxygen objective in all samples, Bell Creek met the objective in all but 1 sample, and Glen Annie met the objective in all but two samples in 2014. Arroyo Paredon, however, met the objective in only three samples. At the one site where the minimum objective for protection of warm water aquatic life (5 mg/L) applies, Bell Creek met the objective in all samples as it had in previous years. In terms of the objective to meet 85% dissolved oxygen levels or greater on a median annual basis, Franklin Creek and Glen Annie met the objective while Bell Creek and Arroyo Paredon fell short (80% and 65%, respectively). All South Coast sites met minimum pH objectives (7 standard pH units) in 2014. All sites also met the maximum pH objective of 8.3 standard pH units on an average basis, but Franklin Creek exceeded this in 2 samples.

Trend analysis identified an increasing trend in pH in Bell Creek by 2013, but there was no obvious change from 2013 to 2014 and the exceedance pattern doesn’t appear to be increasing. Dissolved oxygen in Glen Annie may have improved slightly, but none of the South Coast sites had heavy exceedance patterns for these parameters to begin with.

Table 3-1. Site-specific Basin Plan objectives for CMP monitoring sites

CMP Site Tag	Waterbody Names	pH	DO, mg/L	DO Saturation, %	TDS, mg/L	Ammonia as N, mg/L	Unionized Ammonia as N, mg/L	EC, µS/cm	Nitrate as N, mg/L	Notes
PAJARO RIVER HYDROLOGIC UNIT										
305PJP	Pajaro River	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*, 10	1, 4
305CHI	Pajaro River	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*, 10	1, 4
305FRA	Millers Canal at Frazier Lake Rd	7-8.5	5	85%	none	none	0.025	none	none	2, 3
NA	San Benito River	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*, 10	1, 4
305SJA	San Juan Creek at Anzar Rd	7-8.5	5	85%	none	none	0.025	none	none	2, 3
305TSR	Tequisquita Slough	7-8.5	7	85%	none	none	0.025	none	none	
305LCS	Llagas Creek (below Chesbro Res.)	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*, 10	1, 4
305CAN	Carnadero Creek	7-8.3	7	85%	none	none	0.025	none	10	1
305COR	Salsipuedes Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*, 10	1, 4
305WSA	Watsonville Slough	7-8.5	7	85%	none	none	0.025	none	none	
305STL	Struve Slough	7-8.5	7	85%	none	none	0.025	none	none	
SALINAS HYDROLOGIC UNIT										
306MOR	Moro Cojo Slough	7-8.5	7	85%	none	none	0.025	none	none	
309OLD	Old Salinas River Estuary	7-8.5	7	85%	none	none	0.025	none	none	
309TEH	Tembladero Slough	7-8.5	7	85%	none	none	0.025	none	none	
309MER	Merrit Ditch upstream from Highway 183	7-8.5	5	85%	none	none	0.025	none	none	2, 3
309ESP	Espinosa Slough	7-8.5	5	85%	none	none	0.025	none	none	
309JON	Salinas Reclamation Canal	7-8.5	5	85%	none	none	0.025	none	none	
309ALG	Salinas Reclamation Canal	7-8.5	5	85%	none	none	0.025	none	none	
309NAD	Natividad Creek upstream from Salinas Rec. Canal	7-8.5	5	85%	none	none	0.025	none	none	2, 3
309GAB	Gabilan Creek	7-8.3	7	85%	300	*Var*	0.025	*Var*	*Var*, 10	1, 4
309ASB	Alisal Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*, 10	1, 4
309BLA	Blanco Drain	7-8.5	5	85%	none	none	0.025	none	none	
309SSP	Salinas River, dnstr of Spreckels Gage	7-8.3	7	85%	600	*Var*	0.025	*Var*	*Var*, 10	1, 4
309SAC	Salinas River, Spreckels Gage-Chualar	7-8.3	7	85%	600	*Var*	0.025	*Var*	*Var*, 10	1, 4
309QUI	Quail Creek at Highway 101	7-8.5	5	85%	none	none	0.025	none	none	2, 3
309GRN	Salinas Riv, Chualar-Nacimiento Riv	7-8.3	7	85%	600	*Var*	0.025	*Var*	*Var*, 10	1, 4
309SAG	Salinas Riv, Chualar-Nacimiento Riv	7-8.3	7	85%	600	*Var*	0.025	*Var*	*Var*, 10	1, 4
309CRR	Chualar Creek at Chualar River Road	7-8.5	5	85%	none	none	0.025	none	none	2, 3
ESTERO BAY HYDROLOGIC UNIT										
310CCC	Chorro Creek	7-8.3	7	85%	500	*Var*	0.025	*Var*	*Var*, 10	1, 4
310WRP	Warden Lake Wetland	7-8.5	7	85%	none	*Var*	0.025	*Var*	*Var*	4

CMP Site Tag	Waterbody Names	pH	DO, mg/L	DO Saturation, %	TDS, mg/L	Ammonia as N, mg/L	Unionized Ammonia as N, mg/L	EC, µS/cm	Nitrate as N, mg/L	Notes
310SLD	Davenport Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
310PRE	Prefumo Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
310USG	Arroyo Grande Creek, downstream	7-8.3	7	85%	800	*Var*	0.025	*Var*	*Var*	1, 4
310LBC	Los Berros Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
SANTA MARIA HYDROLOGIC UNIT										
312OFC	Oso Flaco Creek	7-8.3	5	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
312OFN	Oso Flaco Creek	7-8.3	5	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
312SMA	Santa Maria River Estuary	7-8.5	7	85%	none	none	0.025	none	none	
312SMI	Santa Maria River	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
312BCC	Bradley Canyon Creek	7-8.5	5	85%	none	none	0.025	none	none	2, 3
312BCJ	Bradley Channel at Jones Street	7-8.5	5	85%	none	none	0.025	none	none	2, 3
312GVS	Green Valley at Simas	7-8.5	5	85%	none	none	0.025	none	none	2, 3
312MSD	Main Street Canal u/s Ray Road at Highway 166	7-8.5	5	85%	none	none	0.025	none	none	2, 3
312ORC	Orcutt Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
312ORI	Orcutt Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
SANTA YNEZ HYDROLOGIC UNIT										
314SYL	Santa Ynez River, downstream	7-8.3	7	85%	700	*Var*	0.025	*Var*	*Var*	1, 4
314SYF	Santa Ynez River, downstream	7-8.3	7	85%	1000	*Var*	0.025	*Var*	*Var*	1, 4
314SYN	Santa Ynez River, downstream	7-8.3	7	85%	1000	*Var*	0.025	*Var*	*Var*	1, 4
SOUTH COAST HYDROLOGIC UNIT										
315GAN	Glen Annie Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
315APF	Arroyo Paredon	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
315FMV	Franklin Creek	7-8.3	7	85%	none	*Var*	0.025	*Var*	*Var*	1, 4
315BEF	Bell Creek at Winchester Canyon Park	7-8.5	5	85%	none	none	0.025	none	none	2, 3

1 pH WQO based on MUN and COLD, WARM

2 pH and DO objectives based on Basin Plan objectives for sites not specifically listed in table 2-1 of the Basin Plan; Median DO saturation of 85% is based on "*controllable water quality conditions*."

3 Unionized ammonia WQO based on "*discharge of wastes shall not cause concentrations of unionized ammonia (NH3) to exceed 0.025 mg/l (as N) in receiving waters*".

4 *Var* indicates that objective is variable and does not provide a definitive numeric exceedance threshold. Interpretations of objectives for EC, Nitrate-N and Ammonia-N are based on possible effects of constituents on crops and/or soils. Guidelines are flexible and should be modified when warranted by local experience or special conditions of crop, soil, and method of irrigation. Conductivity (EC) objective of 750 µS/cm is the most restrictive objective for AGR (<750, no problems; 750-3000, increasing problems; >3000, severe). Ammonia-N objective of 5 mg/L is most restrictive objective for AGR (5, no problems 5-30, increasing problems; >30, severe). NO3-N objective of 5 mg/L is the most restrictive objective for AGR (5, no problems 5-30, increasing problems; >30, severe). MUN objective for NO3-N is 10 mg/L.

4 DISCUSSION

The results of CMP monitoring were evaluated for spatial and temporal patterns in water quality. Results from the 2014 monitoring year were compared between sites and sub-regions to evaluate differences in water quality across the region. Results from 2014 were also compared to results from a trend analysis that was performed on the period of record from each site (i.e. monthly data since either 2005 or 2006) to evaluate change over time through the end of 2013 and identify continued patterns or additional changes in 2014.

4.1 SPATIAL PATTERNS IN PARAMETERS OF CONCERN

Spatial patterns in monitoring results were evaluated broadly by hydrologic unit. These broad regional patterns are often not reflective of water quality at every individual site within the hydrologic units, nor do they necessarily represent water quality in areas of the hydrologic units not monitored by the CMP. At this broad scale though, there are some important differences between areas of the Central Coast in which CMP sites are located.

Differences in toxicity monitoring results between hydrologic units are illustrated in Figure 4-1. As in the past, toxicity to fish and algae were less common on a regional basis compared to invertebrate toxicity in water and sediment:

- Toxicity to algae was rare overall, and more common in the southern portion of the region, especially in the Santa Maria (312) and South Coast (315) hydrologic units.

- Toxicity to fish was also relatively uncommon in 2014, especially with regard to fish survival rates. Most toxicity to fish was to growth rates in samples from the Santa Maria and Santa Ynez (314) hydrologic units.

- Toxicity to invertebrates in water was most common in the Salinas (309) and Santa Maria hydrologic units, and occurred more frequently overall than algae or fish toxicity.

- Invertebrate mortalities in sediment were the most ubiquitous form of toxicity, occurring in all hydrologic units in which testing was performed.

Monitoring results for routine field and lab-analyzed parameters are summarized in Appendix A:

- The Salinas hydrologic unit had the highest median **turbidity** levels (average turbidities are often skewed by storm events), followed by Santa Maria. Though some sites had median turbidity levels less than 25 NTU, multiple sites in these units had median turbidities over 100 NTU.
- The Santa Maria region had the most elevated **nitrate** concentrations, with medians above 20 mg/L as N at over half the sites.
- The Santa Maria region, followed by the Salinas region had the most exceedances related to **unionized ammonia**. The other hydrologic units did not have unionized ammonia exceedances in 2014.
- The Estero Bay region (310) exhibited the lowest **conductivity**. Each of the other regions had multiple sites with elevated conductivity.

- The South Coast hydrologic unit had the highest frequency of **pH** exceedances. The Salinas, Pajaro, and Santa Maria units also had their share of exceedances, but these did not comprise as large a segment of the total samples as in the South Coast unit.
- **Dissolved Oxygen** exceedances were most common in the Pajaro and Estero Bay hydrologic units, followed closely by the Santa Ynez.

4.2 TEMPORAL PATTERNS – CHANGES AND TRENDS OVER TIME

A primary objective of the CMP is to detect trends in water quality over time, should changes occur. In 2010 a power analysis was conducted which indicated varying levels of statistical power to detect trends with the Mann Kendall test based upon the monthly monitoring schedule, observed variability in past CMP monitoring results, and test scenarios of 5 to 20 year periods of record (CCWQP, 2010). For example, high variability in turbidity monitoring results limits the CMP's power to detect trends such that in a 5 to 10 year monitoring period, 50% reductions in turbidity levels would be needed to create a detectable trend at even 10% of the CMP sites (CCWQP, 2010). In contrast, salinity-related parameters tend to be less variable such that 30% changes in conductivity (or salinity or TDS) can be reliably detected at 40% of CMP sites in just 5 years. Trend analysis performed on the first five years of CMP results identified 290 trends (i.e. statistically significant changes over time) out of 1388 possible site-by-parameter combinations. In other words, about 21% of possible trends were significant, although not all of the site-by-parameter combinations necessarily supported statistical power to detect trends in the first place, so the percentage of trends found in circumstances that actually yielded sufficient power is likely higher than that. These figures do not include toxicity-related parameters due to the less frequent monitoring schedule.

Performed again for the 2013 annual report (CCWQP, 2014) using data through the end of the 2013 monitoring year, the Mann Kendall test identified 680 trends out of 2205 possible site-by-parameter and season combinations, for 31% of possible trends significant. The 2013 trends are detailed in Appendix B and Section 3 of this report (Water Quality Monitoring Results) evaluates 2014 data in the context of those trends (i.e. for continuity or reversals in patterns). More specifically:

- With one exception, trends observed in stream **Flow** were entirely decreasing trends. These were frequently observed, with slightly more trends for the summer months than for winter. Though precipitation was higher in 2014 than in 2013, stream flows remained depressed and in some cases declined further.

- Trends in **pH** were observed throughout the region but more commonly in the north (Pajaro and Salinas hydrologic units), with decreasing trends outnumbering increasing trends in the north, and increasing trends more numerous in the south.

- Increasing trends in Salinity-related parameters (including **Salinity**, **Conductivity**, and **TDS**) were relatively common for the northern sites, especially in summer. Southern sites also exhibited more trends for summer-only months, however decreasing trends tended to outnumber increasing trends in the south. In 2014 conductivity at Warden Creek was higher than in 2013, which is contrary to many other sites in the region, but a decreasing trend was not actually detected there in 2013.

- Trends in **Dissolved Oxygen** were mostly increasing trends, occurred during both summer and winter months, and occurred more frequently in northern hydrologic units than in the south. Increasing dissolved oxygen levels are difficult to interpret, as they can indicate either improved or worsened water quality depending on the time of sampling and the relationship of photosynthesizer communities to biostimulatory substances in the water.

- Trends in **Turbidity** were, with one exception, entirely decreasing trends. These occurred in both summer and winter months, and were slightly more numerous in the north but also substantially present in the south. In 2014 turbidities remained lower than historic levels, however several sites had increased average turbidity relative to 2013 due to the influence of storm events and/or events with no water in the channel.

- **Orthophosphate** trends were generally in the increasing direction. These were relatively evenly distributed between the north and south, although (as in 2012/2013) the Santa Maria region had disproportionately few Orthophosphate trends given the higher number of sites in that hydrologic unit relative to others. The trends were observed at relatively similar frequencies for both winter and summer months.

- Overall, more decreasing trends were observed for **Nitrate** than increasing. However, the northern sites as a distinct group exhibited more increasing trends than decreasing. It was the southern sites which showed a stronger pattern of predominantly decreasing trends. There were more trends observed in summer months than in winter months, but increasing versus decreasing trends were relatively well distributed between seasons.

- Trends in **Total Ammonia** were somewhat distributed, but decreasing trends were slightly more numerous in the south and in the winter months. Trends in **Unionized Ammonia** were more numerous, with decreasing trends in the Pajaro and a mixed bag of increasing and decreasing trends in other hydrologic units, particularly across seasons.

Monitoring for parameters related to aquatic toxicity occurs less frequently and as such this portion of the dataset does not lend itself as readily to statistical trend analysis as the other parameters. Even so, several patterns of reduced toxicity became apparent in the 2013 analysis. Many of these were sustained in 2014, though a few were not. More specifically:

- In the **Pajaro Hydrologic Unit**, three sites which had shown **Toxicity to Algae** in prior years did not show toxicity to algae in 2011, 2012, 2013, nor 2014, which appears to indicate improvement. Improvements may also be indicated by the fact that **Toxicity to Fish** was completely absent in 2012, and also mostly absent (with one exception each) in 2013 and 2014, whereas most of the sites showed some toxicity to fish in earlier years. Nearly the same could be said for **Toxicity to Invertebrates in Water**, with one exception in 2012 and two in 2013. There were even more exceptions in 2014, which may indicate a lapse in improvements to toxicity to invertebrates in water in the Pajaro region. Though closer analysis could discover site-specific patterns, there were few strong changes in the dataset for **Toxicity to Invertebrates in Sediment**, with continued patterns of toxicity.
- In the **Salinas Hydrologic Unit**, nine sites which had shown **Toxicity to Algae** in prior years did not show toxicity to algae in 2012, and only one 2013 sample showed any toxicity to algae in this hydrologic unit. There were three samples with toxicity to algae in 2014, but this is still a very low rate. Improvements may also be indicated by the fact that **Toxicity to Fish** was not observed in 2012 at 10 sites where it was observed in prior years, whereas most of the sites showed some toxicity to fish in the past. The exceedance rate for fish in 2013 was similar to 2012, and there were no samples with toxicity to fish in 2014. Both the number of toxic samples and number of sites showing **Toxicity to Invertebrates in Water** were reduced from prior years to 2012, and again

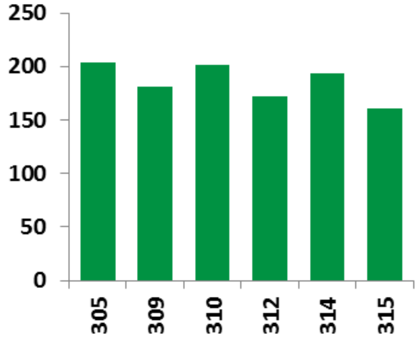
from 2012 to 2013. Further reductions were *not* observed in 2014 however. Though closer analysis could discover site-specific patterns, there were few strong changes in the 2012-2014 datasets for **Toxicity to Invertebrates in Sediment**, with all sites showing toxicity in 2014.

- In the **Estero Bay Hydrologic Unit**, the one site with a history of **Toxicity to Algae** did not show such toxicity in 2012-2014, which may indicate improvements. Improvements may also be indicated by the fact that **Toxicity to Fish** was completely absent in 2012-2014, whereas several of the sites showed some toxicity to fish in earlier years. **Toxicity to Invertebrates in Water** appears to be in a declining pattern that continued in 2014. The **Toxicity to Invertebrates in Sediment** may also have shown a small degree of improvement at specific sites in 2012-2014, though for two years in a row the Warden Creek samples could not be analyzed due to resident *Hyalella*.
- In the **Santa Maria Hydrologic Unit**, six sites with a history of occasional **Toxicity to Algae** did not show such toxicity in 2012, and the exceedance rate in 2013 was the same as for 2012, which seems to indicate sustained improvement over prior years. Incidences of toxicity to algae in 2014 were also very limited, continuing the trend. Improvements may also be indicated by the fact that **Toxicity to Fish** was nearly absent in 2012, whereas most of the sites and about 17% of samples showed some toxicity to fish in earlier years. A few more sites showed toxicity to fish in 2013 than had in 2012, and four sites showed toxicity to fish in 2014, suggesting a possible lapse in improvement. All sites had shown relatively frequent **Toxicity to Invertebrates in Water** in the past, but in 2012 one site showed no toxicity and the majority of samples collected over the course of the year were not toxic. The percent of samples showing toxicity to invertebrates was further reduced in 2013, to 19% (down from 23% in 2012 and 81% in early years of the program. In 2014 however the incidence of toxicity to invertebrates in water increased from 2013 levels, indicating a possible lapse in improvement. The 2013 data do not indicate improvements to **Toxicity to Invertebrates in Sediment.**
- In the **Santa Ynez Hydrologic Unit**, the 2012 and 2013 results showed a similar lack of **Toxicity to Algae** and **to Fish** as in prior years. In 2014 however, there was toxicity to fish growth rates at all three sites in February. All three sites may be showing improvements to **Toxicity to Invertebrates in Water** however, which was not observed at any Santa Ynez site in 2012-2014. No **Toxicity to Invertebrates in Sediment** was observed in 2012 or 2013 either, and will be sampled again in 2017.
- In the **South Coast Hydrologic Unit**, two sites in 2013 and one in 2014 showed **Toxicity to Algae**, which is generally in line with prior results though perhaps slightly reduced. There was no **Toxicity to Fish** observed in 2013 or 2014. The 2012 dataset indicated possible improvements in **Toxicity to Invertebrates in Water** as compared to prior years, however more of the 2013 and 2014 results showed toxicity, indicating a lapse in improvements. Results for **Toxicity to Invertebrates in Sediment** were similar to prior years in 2012-2014.

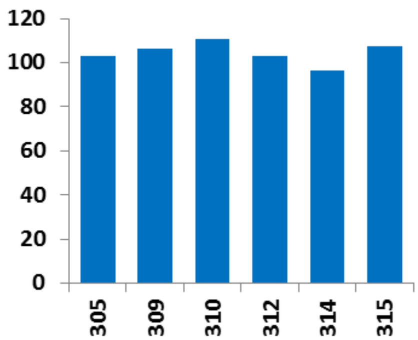
Figure 4-1. Summary of toxicity in water and sediment samples from 2013

Bars represent the average survival, reproduction, or growth rate for all 2013 samples at each site, as compared to laboratory controls. In a year of monitoring there are usually (at each site) 4 water sampling events (including algae, fish, and invertebrates), and 1 sediment sampling event.

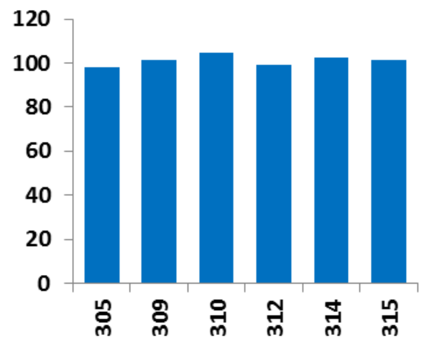
HUC Key: 305=Pajaro; 309=Salinas; 310=Estero Bay; 312=Santa Maria; 314=Santa Ynez; 315=South Coast



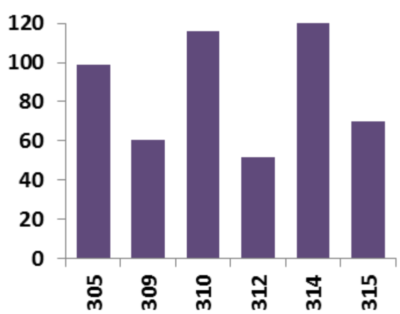
a) Algae toxicity in water - growth



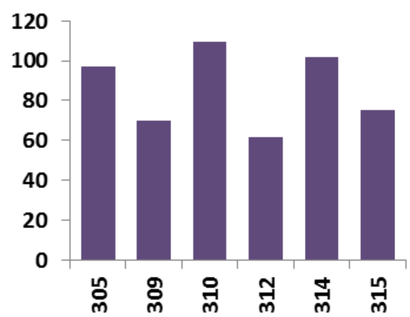
b) Fish toxicity in water - growth



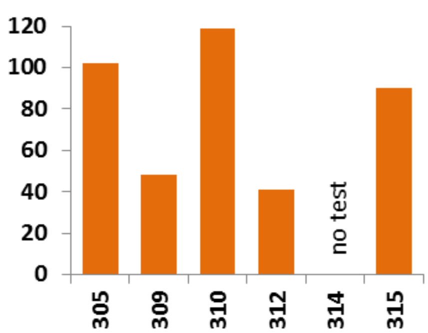
c) Fish toxicity in water - growth



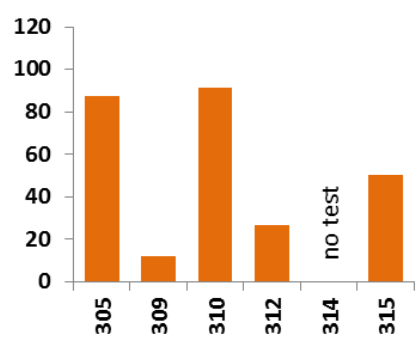
d) Invertebrate toxicity in water - reproduction



e) Invertebrate toxicity in water - survival



f) Invertebrate toxicity in sediment - growth



e) Invertebrate toxicity in sediment - growth

5 SUMMARY AND CONCLUSIONS

All 12 CMP water column and sediment monitoring events planned for 2014 were successfully conducted, with a total of 430 of 607 planned site visits resulting in samples being collected; for a 71% sampling success rate. Of the site visits not resulting in samples being collected, 61 were because the sites were dry, 112 were because there was no connectivity between the sampling site and downstream water bodies, and 2 were due to inability to access the site. All of the collected samples were analyzed. The monitoring results were evaluated in accordance with the CMP QAPP (CCWQP 2013) and determined overall to be of high quality with few qualifications on their use.

There were some broad regional patterns observed in the CMP monitoring results:

- The two regions with sites located in the most intensively cropped drainages (Santa Maria region and the Salinas region) had the highest average turbidity, unionized ammonia, and nitrate results. Dissolved oxygen, pH and conductivity exceedances were more frequent in other hydrologic units (Estero Bay, Pajaro, and South Coast) but still occurring in Salinas and Santa Maria as well.
- Toxicity to fish and algae were relatively infrequent in all regions compared to invertebrate toxicity in water and sediment, however a few sites may have shifted from declining levels or no toxicity to fish/algae in 2012 to minor but increasing levels beginning in 2013 or 2014.
- The highest frequency of toxicity to invertebrate test species was observed in the Salinas and Santa Maria hydrologic units (HUs 309 and 312) in sediment and water column toxicity tests. The South Coast and Pajaro regions also exhibited sediment toxicity in a substantial number of samples.
- About 31% of possible site/parameter combinations for conventional parameters (i.e. not toxicity-related) showed trends, or changes in water quality in 2013, most of which continued in 2014.
- There were few trends in Turbidity, and these were generally decreasing , occurring in both north and south, and in summer and winter seasons.
- There were many trends in Flow, and these were almost entirely (with one exception) decreasing trends and occurred especially in the summer months (dry season).
- Trends in Dissolved Oxygen were mostly increasing, occurring more in the north than in the south. This could indicate improvements, or could conversely be part of a worsening trend involving reduced oxygen levels at night, caused by the same algal populations responsible for the daytime highs. The CMP does not monitor dissolved oxygen at night.
- Both Ammonia-related parameters and Orthophosphate displayed trends, however directionality, geography, and seasonality of these were somewhat scattered and difficult to interpret on a regional basis. Generally speaking, orthophosphate exhibited more increasing trends and ammonia-related parameters exhibited more decreasing trends.
- Trends in pH were observed throughout the region but most commonly in the north, with more decreasing than increasing. Trends in Salinity-related parameters were predominantly increasing in the north and decreasing in the south, especially in the summer season.
- Overall, more decreasing trends were observed for Nitrate than increasing. However, the northern sites as a distinct group exhibited more increasing trends than decreasing. It was the southern sites which showed a stronger pattern of predominantly decreasing trends. There were more trends observed in summer months than in winter months, but increasing versus decreasing trends were relatively well distributed between seasons.

The CMP results from 2014 continue to support the conclusion that low dissolved oxygen, elevated pH, elevated nitrate and ammonia, and water and sediment toxicity are parameters of concern in many water bodies in the Central Coast region. However, the presence of statistically significant trends indicates that some conditions may be changing. In many cases a sharp contrast between 2012/2013 results and those from early years of the program was apparent. Those changes, many for the better, were largely sustained in 2014. However some of the improving trends in toxicity parameters lapsed in 2014, particularly for toxicity to invertebrates in water. This bears a close watch in future years, especially as precipitation returns to more normal levels and water flows increase.

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Appendices A through G are provided as separate electronic documents